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THE

Tea Research Institute

OF

Ceylon

BULLETIN No. 39

Annual Report for the Year 1957

Published by
THE TEA RESEARCH INSTITUTE OF CEYLON
ST. COOMBS, TALAWAKELLE, CEYLON.
1958.

COMMONWEALTH MYCOLOGICAL INSTITUTE
19 NOV 1958

The Tea Research Institute of Ceylon

Staff at December 31st 1957

Director	...	Vacant
Acting Director	...	J. A. H. Tolhurst, B.Sc. (Hons. Agric. Chem.) (Reading).
Chemistry		
Agricultural Chemist	...	J. A. H. Tolhurst, B.Sc. (Hons. Agric. Chem.) (Reading).
Research Assistant, Biochemistry	...	M. S. Ramaswamy, B.Sc. (Hons.) (Mysore), A.R.I.C., A.I.I.Sc.
Senior Technical Assistants	...	E. N. Perera and V. Mendis
Technology		
Technologist	...	E. L. Keegel
Assistants	...	S. M. Guneratnam and K. Sothisrihari
Plant Physiology		
Plant Physiologist	...	T. Visser, Dr., Ir. (L. Wageningen)
Vegetative Propagation Officer	...	F. H. Kehl
Senior Technical Assistants	...	M. Piyasena and L. M. de W. Tillekeratne, B.Sc. (Cey.)
Assistants	...	A. C. B. Pethiyagoda, D. D. Kroon, H. B. Ratnayake, and J. I. H. Bandaranayake.
Pathology		
Pathologist	...	Vacant
Research Assistant	...	N. Shanmuganathan, B.Sc. (Hons.) (Cey.)
Assistants	...	M. K. Vythilingam, J. V. Sabanayagam, S. Murugiah and P. A. John
Entomology		
Entomologist	...	G. D. Austin
Entomologist, Special Research	...	E. Judenko, Ph.D. (Cracow)
Research Assistant	...	D. Calnaido, B.Sc. (Hons.) (Cey.)
Senior Technical Assistant	...	D. J. W. Ranaweera
Assistants	...	C. Shanmugam, E. F. W. Fernando and G. B. Rajapakse
Engineering		
Maintenance Engineer	...	D. V. W. Perera, A.M.Inst.B.E.
Works Clerk	...	R. A. Daniel
Storekeeper	...	I. P. Dissanayake
Electrician	...	W. R. Solomon
Mechanics	...	D. A. S. Opatha and K. S. Vadivelu
St. Coombs Estate		
Superintendent	...	T. B. Pethiyagoda
Tea Maker	...	A. T. Fernando
Apothecary	...	S. P. de Silva
Office Staff	...	P. E. de Silva and G. L. A. Thomas
Low-Country		
Scientific Adviser	...	A. W. R. Joachim, O.B.E., B.Sc. (Hons.) (Lond.) Ph.D., F.R.I.C., Dip. Agric. (Cantab.)
Assistant	...	F. P. Jayawardene
Administration		
Administrative Secretary	...	G. A. D. Kehl
Personal Assistant to the Director	...	A. C. Perera
Assistant Secretary	...	C. Kirthiratne, A.C.C.S. (Lond.), F.R.Econ.S.
Accounting Assistant	...	A. H. B. Dias
Office Staff	...	F. G. de Sielvie, D. C. W. T. Amarasingha, R. I. Pereira, W. P. Chandrasekera, P. N. Costa, J. P. J. E. Navaratne and V. A. Rangala

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THIRTY-SECOND ANNUAL REPORT OF THE BOARD OF THE TEA RESEARCH INSTITUTE OF CEYLON FOR THE YEAR 1957

Foundation.—The Tea Research Institute of Ceylon was established by Ordinance No. 12 of 1925 dated 27th October, 1925.

The personnel constituting the Board of Control is laid down in the above Ordinance and in the following Tea Research (Amendment) Acts:—

No. 24 of 1948 dated 20th December, 1948
No. 51 of 1953 ,, 19th ,, 1953
No. 20 of 1955 ,, 14th April, 1955

The members of the Board on 1st January, 1957, were:—

Ex-Officio Members

The Director of Agriculture (Dr. M. F. Chandraratna, M.B.E.).

The Hon'ble the Minister of Finance (represented by Mr. R. H. Wickramasinghe, M.B.E., Deputy Secretary to the Treasury).

The Chairman, Planters' Association of Ceylon (Senator T. Amarasuriya, O.B.E.).

The Chairman, Agency Section, Planters' Association of Ceylon (Mr. R. M. Macintyre).

The Chairman, Low Country Products Association of Ceylon (Senator E. W. Kannangara, C.B.E.).

The Tea Controller (Mr. B. Mahadeva).

Representatives of the Planters' Association of Ceylon

Mr. R. C. Scott, C.B.E.
Mr. N. B. Parker
Mr. W. H. W. Coultas

Representatives of the Planters' Association of Ceylon, Agency Section

Mr. A. D. McLeod
Mr. G. K. Newton
Mr. G. J. Harris

Representatives of the Low-Country Products Association

Mr. J. L. D. Peiris

Mr. B. Amarasuriya

Mr. F. Amarasuriya

Representatives of the Small Holders

Mr. V. G. W. Ratnayaka, M.B.E.

Mr. A. G. Divitotawela

Representative of the House of Representatives

Mr. S. Jinadasa, M.P.

Chairman: Mr. F. Amarasuriya

Secretary: Mr. G. A. D. Kehl

Solicitors: Messrs. Julius & Creasy

Auditors: Messrs. Ford, Rhodes, Thornton & Co.

Registered Office: St. Coombs, Talawakelle.

The following changes in the personnel of the Board were recorded during the year:—

Ex-Officio Members.—Mr. H. E. Peries, O.B.E., Deputy Secretary to the Treasury, was nominated to fill the vacancy created by the death of Mr. R. H. Wickramasinghe as from 1st June.

Mr. A. D. McLeod, Chairman, Agency Section, Planters' Association of Ceylon, vice Mr. R. M. Macintyre, as from 19th June.

Mr. D. C. L. Amerasinghe, Acting Tea Controller, acted for Mr. B. Mahadeva during his absence from the Island.

Representatives of the Agency Section, Planters' Association of Ceylon.—Mr. R. M. Macintyre vice Mr. A. D. McLeod as from 19th June.

Representatives of the Planters' Association of Ceylon.—Mr. N. M. Sanders acted for Mr. W. H. W. Coultas as from 17th October.

Representatives of the Low-Country Products Association.—Mr. Errol Jayawickreme vice Mr. B. Amarasuriya as from 19th December.

Three meetings of the Board were held during the year, on 22nd March, 7th June and 5th September.

Committees.—FINANCE COMMITTEE.—The Chairman, T.R.I. (Mr. F. Amarasuriya), the Chairman, Planters' Association of Ceylon (Senator T. Amarasuriya, O.B.E.), the Chairman Planters' Association of Ceylon, Agency Section (Mr. R. M. Macintyre), Mr. R. H. Wickramasinghe, M.B.E. (Deputy Secretary to the Treasury), Mr. J. L. D. Peiris, Mr. A. D. McLeod, the Director, T.R.I., and Mr. G. A. D. Kehl (Secretary).

The following changes took place during the year:—

Mr. A. D. McLeod (Chairman, Agency Section, Planters' Association of Ceylon) vice Mr. R. M. Macintyre as from 19th June.

Mr. R. M. Macintyre vice Mr. A. D. McLeod as from 19th June.

Mr. H. E. Peries, O.B.E., Deputy Secretary to the Treasury, filled the vacancy created by the death of Mr. R. H. Wickramasinghe.

Four meetings were held during the year, on 4th April, 7th June, 5th September and 5th December.

STANDING COMMITTEE.—Mr. F. Amarasuriya (Chairman), Mr. B. Mahadeva, Mr. R. M. Macintyre, Senator E. W. Kannangara, C.B.E., Mr. A. D. McLeod, the Director, T.R.I., and Mr. G. A. D. Kehl (Secretary).

The following changes occurred during the year:—

Mr. W. H. W. Coultas was added on to the Committee as from 5th September.

Mr. D. C. L. Amarasinghe, Acting Tea Controller, acted for Mr. B. Mahadeva during his absence from the Island.

Three meetings were held on 8th March, 9th August and 8th November.

EXPERIMENTAL AND ESTATE COMMITTEE.—Chairman, the Director, T.R.I. Mr. F. Amarasuriya (Chairman, T.R.I.), the Visiting Agent, St. Coombs Estate (Mr. G. K. Newton), the Superintendent, St. Coombs (Mr. E. S. Rose), the Chairman, Planters' Association of Ceylon (Senator T. Amarasuriya, O.B.E.), Mr. R. C. Scott, C.B.E., Mr. D. E. Hettiarachchi, Mr. S. P. Vytilingam, Mr. R. C. P. Adams, Mr. R. L. Harvey, Mr. J. E. Davidson, Mr. A. Watt, Mr. K. Morford, C.B.E., Mr. R. J. S. Bean, Mr. T. Kane, Mr. M. H. Villiers, the Senior Staff, the Vegetative Propagation Officer, the Research Assistant to Biochemist and Mr. B. N. Webster (Convener).

The following changes took place during the year:—

Messrs. W. L. Meikle, R. Beadon, D. L. Cowling and E. N. Whitfield acted for Messrs. J. E. Davidson, R. C. P. Adams, A. Watt and R. J. S. Bean respectively during their absence on leave.

Mr. T. B. Pethiyagoda, Superintendent, St. Coombs, vice Mr. E. S. Rose as from 1st May.

Mr. E. L. Keegel was appointed Convener on the retirement of Mr. Webster.

LOW-COUNTRY COMMITTEE.—Mr. F. Amarasuriya, Mr. J. L. D. Peiris, Mr. R. J. S. Bean (Co-opted), Mr. G. K. Newton, the Director, T.R.I. and Dr. A. W. R. Joachim, O.B.E. (Convener).

Three meetings were held on 30th July, 4th September and 7th October.

SMALL HOLDINGS COMMITTEE.—Mr. V. G. W. Ratnayaka, M.B.E. (Chairman), Mr. B. Mahadeva, Mr. F. Amarasuriya, Mr. A. G. Divitotawela, the Director, T.R.I. and Mr. R. L. Illankoon (Convener).

Two meetings were held on the 21st March and 6th June.

Appointments Committee.—Mr. F. Amarasuriya (Chairman), the Director of Agriculture (Dr. M. F. Chandraratna, M.B.E.), Mr. J. L. D. Peiris, Mr. B. Mahadeva, Dr. E. D. C. Baptiste (Director, Rubber Research Institute), the Director, T.R.I., and Mr. G. A. D. Kehl (Secretary).

Three meetings were held on 9th April, 1st November and 14th November.

Building Committee.—Mr. F. Amarasuriya (Chairman), Mr. J. L. D. Peiris, Mr. G. K. Newton, Mr. W. H. W. Coultas, the Director, T.R.I. and Mr. G. A. D. Kehl (Secretary).

Co-ordinating Sub-Committee.—On the 7th June the Board appointed Messrs. F. Amarasuriya, R. M. Macintyre, J. E. Davidson, R. J. S. Bean and B. Mahadeva (Tea Controller) as Convener to investigate and report on the future organisation and expansion of the Institute, with particular reference to future staff requirements. The Committee held three meetings.

Trustees of the Junior Staff Provident Fund.—The Chairman, T.R.I. (Mr. F. Amarasuriya), the Director, T.R.I., Mr. V. G. W. Ratnayake, M.B.E., Mr. A. D. McLeod and Mr. E. N. Perera representing the Junior Staff.

Committee of Management, Junior Staff Medical Fund.—The Chairman, T.R.I. (Mr. F. Amarasuriya), the Director, T.R.I., and Mr. G. D. Austin, representing the Junior Staff.

Visiting Agent.—Mr. G. K. Newton continued as Visiting Agent for St. Coombs Estate. He paid two visits during the year, on 25th January and 2nd May.

Finance.—All sources of income registered slight increases as compared to the previous year. Cess collections were higher by Rs. 103,374/- while the profit from St. Coombs Estate was higher by Rs. 57,354/- (exclusive of bonuses paid to estate staff). Income from other sources registered an increase of Rs. 10,790/-. The total income for the year (Rs. 2,402,418/-) was accordingly more than in 1956 by approximately one and threequarter lakhs.

Total revenue expenditure (excluding depreciation) amounted to Rs. 1,476,768/- as compared with Rs. 1,638,687/- for the previous year. The decrease in revenue expenditure, Rs. 161,919/-, was due to decreased expenditure on such items as the library, roads, sanitation and maintenance of buildings.

Capital expenditure for the year which amounted to Rs. 902,126/- as compared with Rs. 359,415/- in 1956 was made up by the following items:— Land development Rs. 219,768/-, Buildings Rs. 508,912/-, Furniture Rs. 68,800/-, Equipment Rs. 73,825/-, Vehicles Rs. 18,490/-, Vegetative Propagation Rs. 12,338/-. The total accumulated depreciation as at 31st December, 1957, was Rs. 1,390,491/-.

After allowing for such liabilities as Furlough Pay and Passages Rs. 42,409/-, Small Holdings Advisory Service Rs. 221,205/-, Sundry Creditors Rs. 205,729/-, net liquid assets as at 31st December, 1957, amounted to Rs. 2,345,486/-.

Small Holdings Advisory Service.—The income for the year was made up chiefly by the annual grant of Rs. 300,000/- from the Institute. Other

items which contributed to the total of Rs. 314,760/- were interest Rs. 13,913/-, profit on Manure and Tea Seed Rs. 568/- and Sale of Publications Rs. 279/-.

Revenue expenditure, excluding depreciation, amounted to Rs. 322,534/- for the year. Excess of income over expenditure (excluding depreciation) was therefore Rs. 82,225/-.

Capital expenditure amounted to Rs. 16,052/-, the chief items being a new car (Rs. 13,300/-) and photographic equipment Rs. 2,752/-.

New liquid assets as at 31st December, 1957, amounted to Rs. 570,653/- after allowing for liabilities but excluding depreciation. Rs. 295,575/- of this amount has been invested in Ceylon Government Loans.

St. Coombs Estate.—The year's working account showed a profit of Rs. 345,957/- (excluding bonuses) as compared with Rs. 288,602/- in 1956. The crop harvested for the year was 286,171 lb. giving a yield per acre of 1,074 lb. as compared with a crop of 246,420 lb. and a yield per acre of 922 lb. in 1956. The net sale average was Rs. 2.88 as compared with Rs. 3.08 in 1956.

Publications.—Receipts from subscriptions and sundry sales amounted to Rs. 9,884/- and from advertisements amounted to Rs. 1,330/-. Cost of printing and distribution amounted to Rs. 16,508/-.

Publications for the year were confined to one issue of the *Tea Quarterly* which appeared as a combined number, *viz.* Volume XXVIII, Parts 1 and 2, and the Annual Report for 1956, Bulletin No. 38.

Acknowledgements.—The Institute continued to receive the fullest co-operation from the Ceylon Association in London, Planters' Association of Ceylon, the Agency Section of the Planters' Association of Ceylon, Agency Houses and various other bodies connected with the tea industry in Ceylon. The Board's thanks go out to all of them.

The Planters' Association of Ceylon and the Tea Controller have placed at the Board's disposal their meeting rooms for meetings of the Board and various Committees for which again the Board extends its thanks.

Accounts.—Messrs. Ford, Rhodes, Thornton & Co. continued to act as the Institute's Auditors. The Audited Statement of Accounts and the Balance Sheet for the year ended 31st December, 1957, are attached to this report.

Sgd. G. A. D. KEHL,
Secretary.

THE TEA RESEARCH INSTITUTE OF CEYLON

BALANCE SHEET AS AT 31ST DECEMBER, 1957.

1956 Rs.		Rs. Cts.	Rs. Cts.	1956 Rs.			Rs. Cts.	Rs. Cts.
	Accumulated Fund:—				**Fixed Assets:—**			
	Expended on Fixed Assets—							
	Balance at 1st January, 1957	4,166,173.92			3,849,636	Cost	Rs. 4,166,173.92	
	Additions less disposals during the year	842,601.79			359,415	Additions 1957	„ 902,126.38	
			5,008,775.71		4,209,051		Rs. 5,068,300.30	
	Unexpended Fund—					*Less* Sales and scrapped in 1957		
	Balance at 1st January, 1957	1,034,838.79		4,166,174	42,877	at cost	„ 59,524.59	5,008,775.71
	Less: Additions to Fixed Assets less disposals during the year	842,601.79			1,116,085	*Less:* Depreciation—As at 31st December, 1956	Rs. 1,237,242.79	
		192,237.00			130,781	Depreciation 1957	„ 162,893.90	
	Add: Excess of income over expenditure for the year 1957	762,756.94			1,246,866		Rs. 1,400,136.69	
			954,993.94					
				1,237,243	9,623	*Less:* Depreciation on items scrapped or sold	„ 9,644.97	1,390,491.72
5,201,013			5,963,769.65					3,618,283.99
				2,928,931				
196,075	**Creditors and Provisions**		205,729.07					
						Investments at Market Value:—		
100,744	**Provision for Furlough Pay and Passages**		42,409.25		224,150	Ceylon Government Securities		623,918.75
				269,800	45,650	United Kingdom Government Securities		43,071.43
109,012	**Small Holdings Advisory Service**		221,205.25					666,990.18
						Current Assets:		
	Note:—Capital commitments not provided in these accounts amounted to approximately Rs 39,000/-.			315,368		Debtors—General		75,582.88
				54,724		Debtors and other debit balances—Research ...		61,319.07
					64,581	Debtors—Staff—		
					3,654	Loans and recoveries ...	Rs. 44,722.92	
				68,235		Kerosene cookers	„ 3,706.01	
				198,304				48,428.93
				1,771,482		Stocks		175,975.93
						Cash in hand and at banks		1,786,532.24
								2,147,839.05
5,606,844			Rs 6,433,113.22	5,606,844				Rs. 6,433,113.22

We have examined the above balance sheet with the books of the Tea Research Institute of Ceylon and St. Coombs Estate and have obtained all the information and explanations we have required. In our opinion the foregoing balance sheet is properly drawn up so as to exhibit a true and correct view of the financial affairs of the Institute as at 31st December, 1957, according to the best of our information and the explanations given to us and as shown by the books.

(*Signed*) FORD, RHODES, THORNTON & Co,
Chartered Accountants.

Colombo, 4th June, 1958.

SUMMARY OF FIXED ASSETS AND VEHICLES—31ST DECEMBER, 1957.

	ASSET ACCOUNT				DEPRECIATION ACCOUNT				
	Cost at 31-12-56	Additions 1957	Sales and Scrap at Cost 1957	Cost at 31-12-57	Accumulated at 31-12-56	For year 1957	On Assets Sold/Scrapped	Accumulated at 31-12-57	Written down Value at 31-12-57
	Rs. Cts.	Rs. Cts.	Rs. Cts.	Rs. Cts.	Rs. Cts.	Rs. Cts.	Rs. Cts.	Rs. Cts.	Rs. Cts.
Land including Development ...	1,163,446.52	219,768.61	46,657.70	1,336,557.43	74,144.15	5,349.35	—	79,493.50	1,257,063.93
Buildings and Lines .. .	1,995,384.86	508,912.57	—	2,504,297.43	739,431.89	59,116.18	—	798,548.07	1,705,749.36
Furniture and Equipment ..	294,951.08	68,441.54	—	363,392.62	77,319.04	28,446.91	—	105,765.95	257,626.67
—do— Board of Survey . ..	80,291.14	347.94	—	80,639.08	—	8,029.11	—	8,029.11	72,609.97
Laboratory Equipment ...	135,012.84	38,031.76	—	173,044.60	68,278.88	9,287.63	—	77,566.51	95,478.09
Experimental Machinery ..	69,544.92	7,729.28	—	77,274.20	46,771.33	6,954.49	—	53,725.82	23,548.38
Estate Machinery .. .	156,492.47	26,915.39	—	183,407.86	156,492.47	—	—	156,492.47	26,915.39
Workshop Machinery	25,006.67	20.43	—	25,027.10	7,501.98	2,500.66	—	10,002.64	15,024.46
—do— Equipment ..	13,106.72	1,128.83	—	14,235.55	3,507.98	1,310.67	—	4,818.65	9,416.90
—do— Furniture .	3,604.50	—	6.95	3,597.55	—	359.75	—	359.75	3,237.80
Vehicles—Institute .	93,058.05	11,558.63	12,407.50	92,209.18	25,560.14	20,162.62	9,305.64	36,417.12	55,792.06
—do— —Workshop ..	47,024.38	6,933.57	452.44	53,505.51	20,510.10	10,297.07	339.33	30,467.84	23,037.67
Library Shelving	2,391.78	—	—	2,391.78	—	239.17	—	239.17	2,152.61
Spectrophotometer ..	13,589.46	—	—	13,589.46	1,358.94	1,358.94	—	2,717.88	10,871.58
Leaf Hoist	2,055.38	—	—	2,055.38	2,055.38	—	—	2,055.38	—
Lawn Mowers	767.78	—	—	767.78	478.54	76.77	—	555.31	212.47
Monkey Grubber	2,534.77	—	—	2,534.77	1,520.82	253.47	—	1,774.29	760.48
Dusters, Sprayers and Pumps .	20,923.68	—	—	20,923.68	6,236.00	2,092.36	—	8,328.36	12,595.32
Leaf Elevator	10,708.55	—	—	10,708.55	2,141.70	1,070.85	—	3,212.55	7,496.00
Winget Stone Crusher ...	15,733.80	—	—	15,733.80	3,933.45	3,933.45	—	7,866.90	7,866.90
Vegetative Propagation Expansion ...	20,544.57	12,337.83	—	32,882.40	—	2,054.45	—	2,054.45	30,827.95
Rs.	1,166,173.92	902,126.38	59,524.59	5,008,775.71	1,237,242.79	162,893.90	9,644.97	1,390,491.72	3,618,283.99

THE TEA RESEARCH INSTITUTE OF CEYLON

ESTATE WORKING ACCOUNT FOR THE YEAR ENDED 31ST DECEMBER, 1957.

1956 Rs.		Rs. Cts.	Rs. Cts.	1956 Rs.			Rs. Cts.	Rs. Cts.
	ESTATE EXPENDITURE—REVENUE:				TEA SALES—GROSS PROCEEDS:	lbs.		
139,640	General Charges	136,259.30		759,906	Colombo	273,802	826,390.52	
80,413	Upkeep	87,097.18		4,388	Local	1,498	3,192.95	
46,393	Cultivation	51,640.74		3,158	Broken Mixed	8,154	5,140.25	
105,113	Harvesting	105,778.84		197	Experimental Department	238	395.96	
84,460	Manufacture	97,176.79			crush	2,479		
456,019			477,952.85	768,524				835,119.68
11,200	Bonus to Staff					286,171		
9,989	Colombo Brokerage and handling charges		11,478.76			—		
288,602	Balance to Income and Expenditure account		345,956.80	286	Profit on sale of Guatemala Grass			
					Profit on sale of Firewood			268.70
768,810			Rs. 835,388.38	768,810			Rs. 835,388.38	

THE TEA RESEARCH INSTITUTE OF CEYLON

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST DECEMBER, 1957.

1956 Rs.		Rs. Cts.
117,142	Administration of the Board	130,039.21
272,386	Senior Scientific Staff	243,736.64
141,459	Junior Scientific Staff and Minor Employees	168,466.42
29,527	Laboratory	35,559.55
36,782	Library and Publications	15,500.79
110,972	Field and Factory Experiments	127,871.31
64,611	Travelling of the Staff	72,993.59
47,026	Engineering Department	46,828.09
39,880	Maintenance of Buildings	65,306.33
257,667	General Services	163,336.79
146,226	Miscellaneous	34,108.31
300,000	Small Holdings Advisory Service	300,000.00
58,441	Board of Survey—Building Maintenance	—
6,930	Endane Experiments	—
—	Replanting Expenditure	67,638.77
130,782	Depreciation	162,893.90
—	Pembroke Bungalow Water Supply	2,572.00
9,638	Depreciation of Investments	2,809.35
461,430	Balance of Income over Expenditure	762,756.94
2,230,899		Rs. 2,402,417.99

1956 Rs.		Rs. Cts.
288,602	Balance from Estate Working Account	345,956.80
1,912,997	Tea Cess	2,016,370.92
19,673	Interest	35,060.66
1,800	Rent of Cadday	1,800.00
7,827	Profit on Stone Crusher Working	708.03
—	Profit on Sale of Fixed Assets	1,645.03
—	Miscellaneous Receipts	876.55
2,230,899		Rs. 2,402,417.99

REPORT ON ST. COOMBS ESTATE FOR THE YEAR 1957

Staff.—Following the departure of Mr. E. S. Rose in March, Mr. C. W. C. Mossop overlooked the estate till the new Superintendent assumed duties on 1st May.

A double session Schoolmaster was engaged in June, and Mr. Gabriel the part time Schoolmaster was transferred to the office.

All other appointments remained unaltered.

Acreage.—

		A.	R.	P.
Tea in bearing	...	264	3	00
New clearing	...	19	3	28
Green manure clearing	...	27	0	00
Land fit to open in tea	...	5	3	00
Buildings and gardens	...	49	2	11
Fuel clearings	...	36	3	14
Waste land and ravines	...	20	0	24
		423	3	37

During the course of 1957, with the completion of the new dam, $2\frac{1}{2}$ acres of No. 3 field and $\frac{1}{2}$ an acre in No. 2 field went under water and accordingly the acreage under tea in bearing has been reduced from $267\frac{3}{4}$ to $264\frac{3}{4}$ acres. Approximately 15 acres of waste land was opened up in Guatemala grass and these acreages have been adjusted in the statement.

Weather.—(Estate gauge).

		Rainfall inches	*Wet days*	*Sunshine hours*
Registered in 1957	...	97.72	221	1992
Registered in 1956	...	87.37	226	1879
(Decennial average 1947-56)	...	90.12	230	1847

The rainfall recorded in the first 3 months of the year was as low as in 1956, with an even poorer rainfall of only 1.63″ in March, 1957, as against 3.68″ in March, 1956. Again in June and September the rainfall was comparatively low with very heavy rainfall in November and December, the latter month showing a record rainfall of 19.99″. The south west winds were not unusually high till the latter part of July. The total rainfall of 97.72″ for the year was the heaviest since 1952, when 113.53″ were experienced. The decennial average has been 90.12″.

No frost was experienced during the year.

Crop.—

	1957	1956
	lbs.	*lbs.*
Estimate	270,000	270,000
Total crop (including off grades)	286,171	246,420
Yield per acre on 264¾ acres ...	1,074	—
Yield per acre on 267¾ acres ...	—	922

The estimated crop of 270,000 lbs. was exceeded by 16,171 lbs. by the end of December. The 1956 crop was exceeded by 39,751 lbs., giving a yield of 1,074 lbs. per acre or a total crop of 286,171 lbs. for the estate. These results could be considered to be extremely satisfactory in view of the drought conditions that prevailed in January, February, March and September and the unusually heavy rains of November and December. The quality of leaf brought into the factory had to be of a very high order indeed, as the tea market was poor during the whole year and only the best teas fetched good prices.

Prices and Total Crop Sold.—

Year	*Total crop sold*	*Total price*	*Net price*
	lbs.	*cents*	*cents*
1957	283,692	2/94.37	2/90.33
1956	244,127	2/11.88	3,07.82

Prices fetched for St. Coombs teas were high in comparison with the high grown average and the neighbouring estates. Though the average prices for the year are slightly lower than prices fetched in 1956, yet in the light of prevailing market conditions, St. Coombs teas could be said to have fared very well.

The best invoices were:—

Invoice No.	*Month*	*Rs. cts.*
6	February	5.01 per lb.
63	December	5.00 ,,
64	December	5.11 ,,

Cost of Production.—

	1957	1956
	Cost per lb. (Cts.)	*Cost per lb. (Cts.)*
Estimate ...	168.44	171.68
Actual ...	162.04	185.05

Profit on Estate Working.—

1957	...	Rs. 345,956.80
1956	...	Rs. 288,601.98

A sum of Rs. 14,238/67 which represents 4.98 cts. per lb. has to be provisionally deducted from the profit figure, to make allowance for holiday pay liabilities to the labour force to be paid in 1958, to conform with the Auditors' recommendations.

Capital Expenditure.—

1957	Rs. 183,534.77	=	64.19 cts. per lb.
1956	Rs. 98,399.47	=	39.93 cts. per lb.

The main items of Capital expenditure were:—

Waterborne sanitation to lines ...	Rs.	39,850.29
Buildings	,,	47,484.40
New clearings	,,	20,981.07
Ravines to be cleared	,,	6,751.54
Factory	,,	32,015.86
New lines	,,	30,880.40
Opening up 15 acres in Guatemala grass and thatching $8\frac{3}{4}$ acres ...	,,	4,984.86
Refrigerator—Superintendent's Bungalow	,,	750.00

Plucking.—7-8 day rounds were maintained throughout the year, with individual row plucking in new fields. The standard of leaf harvested was high. The plucking incentive system of fixing a datum each day for each field has proved satisfactory, though it did not completely eliminate the need for cash plucking after normal hours or the need to pluck on Sundays.

Estate Roads and Paths.—Routine work on the maintenance of field foot paths and estate roads was carried out.

Fuel Clearings.—About 3 acres of new patna land were put under gum plants, and the old gum fuel clearings were resupplied with young plants.

However, there is still a shortage of firewood on the estate, and it will be many years before the total demands of all the Institute staff for firewood can be met.

Ravines and Boundaries.—Ravines in pruned fields were built up with masonry and planted up with clonal tea plants, where the soil was suitable or with Guatemala grass, where soils tended to be water-logged. The boundaries were kept clean of weeds and cootch throughout the year.

All boundaries with the surrounding estates have been clearly demarcated with drains and all swamp drains were deepened .

Weeding.—The cost of weeding for the year was Rs. 9/55 per acre per mensem against a cost of Rs. 10/16 per acre in 1956, which reduction in cost could be considered satisfactory. Weeding contracts continue to be popular and the excellent cover of tea now established will necessarily keep weeding costs down.

Pests and Diseases.—Spraying started in April and was continued without a break till the end of the year. New Saphire double nozzles were bought at the beginning of the year and these have proved extremely efficient and durable. The pruned fields continued to be sprayed with single nozzles and the incidence of blister on the estate generally was slight.

A few bushes in No. 3 field were found to be infected with Poria and received immediate and thorough attention.

Scarlet and yellow mite attacks were noticed in a number of fields but the bushes attacked were so isolated that spraying against scarlet mite was consi-

dered to be impracticable. However, a patch of about ½ an acre in No. 10 field which was rather uniformly attacked by scarlet and yellow mites was treated with "Spersul" with the co-operation of the Entomology department, and this section is now almost completely free of mites.

It is intended to spray against scarlet mite on a larger scale during the dry months of 1958.

Pruning.—In addition to the acreage laid down in the pruning programme, the clonal area in No. 10 field which was planted in 1952, was also pruned.

In accordance with the recommendations of the Visiting Agent, the type of prune adopted this year was a cut across, 3-4" above the previous cut, taking out the worst knotted branches and cleaning up the whippy branches. All pruning and tipping was on the slope. The growth of new wood and recovery from pruning was best in No. 12 field.

This is the first occasion on which the knife was used in the clonal area planted in 1952, and it was almost impossible to come down below a height of about 22", without seriously reducing the frames of the bushes. However, it is hoped that frames will now be encouraged to develop below this level, when it may perhaps be possible to give another prune at a lower level without effecting the spread of the frames. Clone 18 was rather slow to recover from pruning but all other clones made exceptionally quick recovery.

The following fields were pruned during the months indicated against each field:—

No. 2 field —October
No. 5 ,, — April
No. 10 ,, — June (clonal area—1952 planting)
No. 12 ,, — July

Supplying and Nurseries.—All available basket plants from the No. 1 nursery were put out in vacant patches and built up ravines in field Nos. 5, 7, 10 and 12. Owing to the rather poor results obtained last year with V.P. plants, new top soil from areas which had been under Guatemala grass for a number of years was brought into both the No. 1 nursery and the No. 12 nursery, which was given back to the estate in June, 1957. All these soils had to be fumigated against eelworm and treated with "Intox" and the results in the new V.P. beds so far are extremely encouraging.

The nursery extension in No. 12 field which had been supplied up in 1956 did not make good progress during 1957, and it was suspected that the area was water-logged and also infested with eelworm. However, deep drains were re-cut here and large quantities of well rotted cattle manure applied. Supplies of Clone 2024 and 2025 were subsequently put out. These supplies are now making excellent progress, with Clone 2025 showing more adaptability to this type of soil.

Mossing and Ferning.—All pruned fields were treated with "Limbux" to control moss and lichen. The ferning was done by estate labour, unlike in the past when contractors were responsible for this work in their respective contracts.

Working up Poor Areas.—Although the only field estimated for thatching was No. 5, over and above this acreage, 2½ acres of the 1954 clonal

area in No. 10 field, about 2 acres of the planted up ravines and the whole of No. 2 field were also thatched with Guatemala and mana grass.

Compost when available, was forked in to the poorer patches in fields situated towards the eastern end of the estate.

Manuring.—As a general principle, manure is applied to each field at 6 monthly intervals or when a field has yielded between 450 and 500 lbs. of made tea per acre since the last application of manure, whichever is the earlier. The proportion of nitrogen applied varies between 8 and 9 lbs. nitrogen per 100 lbs. of crop harvested.

The usual system of manuring was carried out throughout the year where the manure was dibbled into the soil over the entire field using 3-prong drag cultivators.

The accepted recommendation of the T.R.I. that every field should receive at least one deep forking in a cycle was put into practice and all pruned fields were deep forked in the alternate row for the first and second applications of manure.

On the recommendation of the Agricultural Chemist, the 1952 clonal area in No. 10 field was given 4 applications of T/488 mixture, at the rate of 36 lbs. 'N' per application and the 1954 clonal areas were reverted to 4 applications of T/175 mixture at the rate of 1 oz. per plant per application.

The following are details of nitrogen and potash applied to individual fields, the mixture used being T.R.I. 488.

Field No.	*Months manured*	1955 *Nit.*	*Pot.*	*Months manured*	1956 *Nit.*	*Pot.*	*Months manured*	1957 *Nit.*	*Pot.*
1	*	—	—	Nov **	36	17	May Aug. Oct. Dec.	36 T/175 T/175 T/175	17
2	April	43	20	March	46	22	Feb.	46	22
	Sept.	46	22	Sept.	40	19	Aug.	36	17
3	April	43	20	March	46	22	Feb.	46	22
	Sept.	46	22	Sept.	40	19	Aug.	36	17
4	Feb.	46	22	April	40	19	Feb.	56	26
	Oct.	36	17	Sept.	53	25	Aug.	46	22
5	May	53	25	May	36	17	June	43	20
	Nov.	46	22	Nov.	40	19	Dec.	36	17
6	May	40	19	May	36	17	May	46	22
	Nov.	53	25	Nov.	46	22	Nov.	40	19
7	May	46	22	May	40	19	May	40	19
	Nov.	53	25	Nov.	36	17	Oct.	46	22
8	May	59	28	May	40	19	April	43	20
	Nov.	53	25	Oct.	36	17	Sept.	46	22
9	March	53	25	May	43	20	April	46	22
	Sept.	46	22	Nov.	40	19	Sept.	46	22
10	Jan.	56	26	May	36	17	April	46	22
	May	46	22	Nov.	40	19	Sept.	46	22
	Oct.	46	22						

* The whole field was uprooted.
** 2 Acres of new clonal area manured.

Field No.	Months manured *	1955 Nit.	1955 Pot.	Months manured **	1956 Nit.	1956 Pot.	Months manured	1957 Nit.	1957 Pot.
10	Jan.	46	22	May	40	19	April	36	17
Clonal area	May	46	22	Nov.	56	26	Sept.	36	17
1952 planting.	Oct.	82	39				Oct.	36	17
							Dec.	36	17
10				Nov.	36	17	April	36	17
Clonal area							Aug.	T/175	
1954 planting.							Oct.	T/175	
							Dec.	T/175	
11	May	40	19	April	46	22	May	46	22
	Oct.	53	25	Aug.	53	25	Oct.	46	22
				Dec.	46	22			
12	May	63	30	April	46	22	May	43	20
	Oct.	46	22	Sept.	53	25	Nov.	36	17
				Dec.	40	19			
13	April	56	26	March	53	25	April	53	25
	Sept.	46	22	Oct.	36	17	Sept.	46	22
	Jan.	56	26	July	59	28	Feb.	46	22
14A	July	56	26	Nov.	43	20	June	53	25
	Dec.	56	26				Oct.	40	19
	Jan.	56	26	July	63	30	Feb.	56	26
14B	July	56	26	Nov.	56	26	June	56	26
	Dec.	59	28				Sept.	53	25
							Dec.	46	22

* The whole field was uprooted.

** 2 Acres of new clonal area manured.

Green Manure and Shade Trees.—Routine supplying and resupplying of Grevillea robusta, Albizzia sumatrana, Albizzia moluccana and dadaps in all fields pruned in 1956 and 1957 was continued throughout the year when weather conditions were favourable. The green manure nursery in No. 14 field has been re-stocked with new basket plants and a new green manure nursery has been started in No. 1 field, for supplying in 1958.

New Clearings.—Tending of plants in the new clearings continued throughout the year. Bigger supplies were cut across and younger ones bent down. The whole of the planted area was resupplied, where deaths had occurred, with clonal plants. Dadaps, Albizzia sumatrana and Grevilleas were resupplied. Block No. 25 was supplied up with Clone 777 in July.

All plants were manured every alternate month with T/175 mixture at the rate of 1 oz. per plant per application. Liberal quantities of compost and well rotted cattle manure were applied to patches where growth was poor. The whole of the planted area was thatched with Guatemala grass, once in May and again in December against a possible drought in January and February, 1958.

Guatemala grass in the balance 10 acres now being reconditioned, was lopped three times during the course of the year and manured soon after lopping.

Ravines were cleaned out and built up with masonry, and the tea areas extended or Guatemala grass planted.

About 15 acres of patna and waste land was cleared and planted up with Guatemala grass for future thatching.

The nursery in No. 1 field has been re-stocked with different clonal plants necessary for resupplying the various blocks in 1958.

A green manure nursery has also been started here to make available shade trees for the whole of the clearings.

Poria infected plants were again found in the plot where Clone 2024 was planted without the recommended interval under Guatemala grass. It will be remembered this block was planted with clonal material, experimentally soon after the old tea was uprooted and if the incidence of Poria were to continue, it may become necessary to uproot again the existing plants in this plot and rehabilitate the soil for a few years before replanting.

Factory and Machinery.—Considerable work was done during the year to improve the factory and existing machinery. The floors of the three porticos were laid with Rubberoid sheets and the walls lined with Unitex sheets and painted. Guard rails were fitted to the front windows in the middle and top lofts.

A preheater unit was installed for the Marshall's drier and pipes laid for the use of furnace fuel. A new front plate arches and flu duct were fitted to the same drier. The Direct Fired Heater of the Davidson's drier was replaced with a Multitubular Air Heater by Messrs. Davidson & Co., Ltd.

Extensive repairs were carried out to the table of the 34" Walkers roller; new battens fadeaway G.M. tips and a new stainless steel jacket were fitted. A new bin for storing refuse tea was provided for the sifting room and the factory was repainted where necessary. The chest nailing room was fitted with a G.E.C. 3 K.W. unit heater with thermostat and fluorescent lights were supplied to the office, rolling room and furnace room.

The factory compound was relaid, the front compound having been metalled and tarred the lawns extended and a centre roundabout with flower beds introduced. The chimney was repainted and a sliding door was added to the firewood shed. A concrete drain was built round the Engine House.

Labour.—A few more children were registered towards the end of the year. There was much labour unrest in the district but on St. Coombs itself there were no incidents.

Another new double storey line was built in 1957 and the amenities provided in these larger living quarters are appreciated by the labour force.

The building of a new school and the commencement of double sessions, has made it possible for more children to be admitted to school.

The provision of cattle sheds and individual lavatory compartments with waterborne sanitation for each family have been greatly appreciated.

Manufacture.—The type of manufacture remained the same during the year. A 4-roll programme was adopted during the quality months and continuous rolling was re-introduced when the weather conditions were normal.

General.—The year under review has been satisfactory as the results show.

The crop harvested has been well above average and the good prices obtained for our teas in Colombo have been maintained, in spite of adverse market conditions.

The general appearance of the tea and the estate in general promises well for a good season in 1958.

T. B. PETHIYAGODA,
Superintendent.

METEOROLOGICAL OBSERVATIONS—1957

ST. COOMBS

(Laboratory Gauges)

MONTH	TEMPERATURES °F						Mean Relative Humidity	RAINFALL		RAINY DAYS		SUNSHINE	
	Mean Maximum	Difference from average (25 years)	Mean Minimum	Difference from average (25 years)	Adopted Mean	Mean on grass		Inches	Difference from average (25 years)	Days	Difference from average (25 years)	Hours	Difference from average (25 years)
January	72.9	—1.2	54.8	—0.9	63.9	53.6	66	2.48	— 1.12	8	— 3	241.43	+48.73
February	73.3	—3.0	54.7	+0.1	64.0	51.6	73	3.40	+ 1.05	9	+ 1	195.35	—15.33
March	76.4	—1.3	53.4	—2.1	64.9	52.2	60	1.57	— 2.97	2	—10	273.43	+40.42
April	77.0	—0.4	56.2	—1.6	66.6	54.9	75	5.86	— 0.51	13	— 3	236.45	+40.01
May	76.5	+4.1	57.9	—1.8	67.2	55.6	75	9.76	— 1.52	19	+ 1	162.73	— 1.27
June	70.9	+0.3	59.4	—1.0	65.2	55.7	83	10.83	— 2.27	23	— 3	119.52	+27.48
July	69.5	—0.7	59.9	+0.4	64.7	58.4	87	12.74	+ 1.00	24	— 2	93.95	—11.24
August	69.0	—2.0	59.4	+0.2	64.2	57.6	85	7.21	— 2.21	20	— 5	95.20	—18.96
September	71.8	—0.4	58.1	—0.1	65.0	54.0	80	3.86	— 4.51	15	— 6	181.00	+40.68
October	73.1	—	57.9	+0.2	65.5	55.4	81	9.45	— 0.24	16	— 6	171.65	+22.29
November	73.2	—0.3	59.0	+1.9	66.1	55.6	84	12.18	+ 4.76	28	+ 9	134.73	—26.79
December	72.0	—1.5	60.0	+3.9	66.0	57.8	81	21.18	+15.96	26	+11	86.80	—82.43
	73.0	—0.5	57.6	—0.1	65.3	55.2	78	100.52	+ 7.42	203	—16	1,992.24	+63.59
	Means							Totals					

REPORT OF THE ACTING DIRECTOR FOR THE YEAR 1957

Staff. The most prominent feature of the Institute's progress during the year has been the high proportion of resignations among the Senior Staff.

The Director, Mr. G. B. Portsmouth, returned from furlough in February and shortly afterwards tendered his resignation, which took effect in September. The Agricultural Chemist, Mr. J. A. H. Tolhurst, who had been Acting Director at the beginning of the year, resumed this post in September. It is hoped that an appointment to the Directorship may be made shortly.

The Technical Assistant to the Director, Mr. J. V. Harbord, resigned from the Institute in January, at the termination of his contract. His duties were apportioned between the Director and the Administrative Secretary, and the post was discontinued.

The Pathologist, Mr. B. N. Webster, also tendered his resignation early in the year in order to take up a post with the Shell Company, and he actually left the Institute on May 21st. The Plant Physiologist, Dr. T. Visser, assumed responsibility for this Section. The post was advertised twice, and the response now suggests that an appointment will be made early in 1958.

The Superintendent of St. Coombs Estate, Mr. E. S. Rose, completed his contract in March, and in accordance with the ruling left the Institute. Mr. T. B. Pethiyagoda was appointed as Superintendent on 1st May on a similar contract.

Late in the year an advertisement was circulated for the post of Senior Entomologist, to fill the vacancy which will follow the retirement of Mr. G. D. Austin. This was due to take place in December, but Mr. Austin generously agreed to continue his services until the new officer could assume duties.

These changes, coinciding within a short period, must inevitably have a damaging effect on the continuity of the Institute's services. New officers require time to familiarise themselves with the work, and those officers who assume acting duties in the interim periods do so at the expense of their own and their section's wellbeing.

Fortunately, there were no important changes in the assistant staff. Interviews were held late in the year for Research Assistants, and it is hoped to appoint two for Agricultural Chemistry and Plant Physiology early in the coming year.

The general concern over the depletion of an already small staff led to the formation of a sub-committee by the Board of Control, where a full discussion of problems could take place between representatives of the tea industry and of the scientific staff. The Co-ordinating Sub-Committee was able to draw upon several memoranda from the scientists, including a report which Prof. F. Hardy compiled after his visit to the Institute. This is related

below. Deliberations are, at the time of writing, still in progress, and although we may not pre-judge the issue, we consider that it is in the interests of all concerned to say that the proceedings have engendered optimism among the scientific staff.

Scientific Visitor.—The Institute was very fortunate in being able to extend hospitality to Professor F. Hardy for four weeks in April, when he resided with the Agricultural Chemist and gave the benefit of his experience in their common research subject. For this we are indebted not only to Professor Hardy for agreeing to undertake a strenuous task, but also to Messrs. Gordon Frazer & Company for having initiated his visit to Ceylon and allowing us to benefit as well. Prof. Hardy has recently retired from the Imperial College of Tropical Agriculture, Trinidad, after a lifetime's experience in tropical soil chemistry and plant nutrition. Comments on his impressions of Ceylon tea soils and the chemistry research projects will be found in the appropriate Sectional Report. In addition, the report resulting from his visit contained valuable information on staff establishment in general.

It is hoped that more visits of this nature may be arranged for all sections, as they are of the greatest value.

Sectional Reports.—By far the most encouraging aspect of the year was the progress made by Dr. A. W. R. Joachim, O.B.E., towards the establishment of the Low-country Sub-Station. Following the approval by the Board of his report, setting out in great detail the requirements and probable lines of development, negotiations were started to purchase a suitable experimental estate. It is anticipated that these will come to fruition early in 1958.

Dr. Joachim generously agreed to extend his contract in order to see the actual station come into being and in order to commence training the new staff, and we are very happy to know that this critical period will be in safe hands. The success to-date has been due to the tremendous enthusiasm with which he has tackled this project, and to the co-operation which this has brought from the low-country planters.

In the Entomologist's report it will be noted that a mistake in an application of a chemical insecticide, such as could so easily occur, led to the rapid build up of another insect population sufficient to attain the level of a pest. There appears to be a large number of insect species which inhabit the tea fields without causing marked damage because their populations are kept in check by natural causes. Fear of stimulating any of these comparatively harmless insects into pest proportions is one reason for our caution in advocating chemical control measures. The practical control of shot-hole borer appears to be but little nearer achievement, but the Special Entomologist has now amassed considerable data on the biology of the beetle.

The success of the parasitism of the tortrix moth caterpillar must rank as one of the greatest achievements of the Institute, and it may not be out of place to give publicity now to what may be forgotten, or looked upon as an accepted historical fact. If the virus wilt of nettle grub should prove to be as successful, the Entomology Section would have cause to be well satisfied. We are grateful to Dr. Kenneth Smith of Cambridge for his co-operation in supplying the virus.

As so much of the time of the Pathology Section has been devoted, over the past three years, to trials of proprietary fungicides and nematocides, it is pertinent to make a general comment on the Institute's attitude towards the

testing of chemicals and equipment of all types. This Section and the Entomology Section in particular receive an ever-increasing stream of requests for such tests and we cannot hope to keep pace with the demand, even if it were the Institute's function to become a mere approval centre. Our small staff must be free to tackle the research problems so urgently demanding attention, and we must consider restricting our trials of proprietary products to those which we believe to be of a new type by comparison with established compounds, or to such as may be required to help in tackling a new pest or disease, etc. The same conditions should also apply to equipment. We feel sure that the suppliers would appreciate this attitude, and we should continue to give them advice to the best of our ability. The detailed experiments on a possible refinement in control of blister blight have proved disappointing insofar as an entirely new copper formulation failed to give consistently satisfactory protection over varied monsoon conditions. We are, however, able to recommend certain reductions in copper output which could enable economies to be made. We can also repeat with added emphasis the value of early protection, *i.e.* before the monsoon sets in, and the further point that in continuously wet periods additional rounds may not have the expected protective effect.

Because of extra administrative duties the Agricultural Chemist had to curtail the proposed programme, and the report reflects this. During the year publicity was given to a fear expressed by certain quarters that the current trend to lower prices and lower quality of made tea was caused by over-generous use of chemical manures. This opinion had to be taken very seriously, because Ceylon tea soils are such that we could hardly hope to produce tea at an economic level, in the face of strong competition from other countries, unless chemical manures could be used freely. The Institute was satisfied that such fears were unjustified and the Chemist compiled a comprehensive article for publication in the *Tea Quarterly* which will be issued very shortly. Meanwhile note should be taken of the Technologist's report on the advisory problems facing his Section, as it is pertinent to this subject.

Biochemistry research was able to maintain a commendable rate of progress relative to the extremely small staff establishment. Of particular interest is the preliminary comment on copper-chlorophyll reactions. This work arose out of findings by the Agricultural Chemist that retention of various copper fungicides by the tea leaf appeared to depend partly on an active reaction between the leaf and the fungicide. This, of course, caused no surprise, but it led to the idea that if copper were actually absorbed into the leaf it might there react with the chlorophyll to give a copper chlorophyll. As this compound is very stable to strong sunlight and is also photosynthetically inactive, there is the possibility of one of two effects occurring in practice, in view of the contrasting light intensities to which tea is subjected, even in the one district.

Attention is also drawn to the comment on the "soluble tea" products which are now coming into the market. Doubtless there will be opposition, as the ritual of tea brewing whether by tea-pot, samovar, or billy-can, appears to exert a strong fascination. The applicability of the already established Biochemistry programme to such development is welcome, and during the future research it will be borne in mind that certain methods of preparation of such soluble products may have economic attractions to the tea industry.

The Technologist had to report unfavourably on a process which hoped to manufacture the well known black tea, but by an entirely different technology. Standardization of miniature manufacturing techniques will be a very welcome adjunct to a proposed intensification of clonal proving trials.

Vegetative propagation received very intensive study by the Plant Physiology Section, with a little assistance from the Chemistry Section. There is still a great need for improvement of nursery techniques in practice and reference to the recommendations resulting from the Section's detailed work should prove invaluable. At the same time this Section was very prompt in following up an observation made by Mr. Sutherland Fraser of Maliboda Estate, on a new pruning method. Results to date are encouraging, and possible practical implications should be noted.

St. Coombs Estate.—In view of the weather in 1957 and certain unfavourable market conditions, the average yield of 1,074 lb. per acre and the average price of Rs. 2/90 per lb. must be considered to be very satisfactory. A marked improvement took place during the year in the appearance and results of the established clonal blocks, apart from those under the control of the Plant Physiology Section, and also in the larger and newer clonal replanting scheme. It must be said that these improvements are due to a policy which bears out all that the Institute has said in recent years concerning the need for generous treatments of both clonal nursery plants and the soil into which they will be planted, and further the necessity of careful attention once the plants are in the field. Another pleasing feature was the excellent protection of blister blight, which , as experimental control blocks showed, could have built up a serious infestation.

Small Holdings Advisory Service.—This Service was transferred to the jurisdiction of the Tea Control Department at the end of December.

General.—The first stage of the water supply scheme was completed, and with the new dam in operation the Institute will now be able to contemplate any desired expansion of housing on St. Coombs with no fear of restriction of a water supply. Plans for a filtration plant are under consideration. We express our thanks to Mr. A. G. Gibbs, the Engineer-in-Charge, who gave up much of his own time to this project, in addition to his other assignment in Ceylon.

Three senior staff and two intermediate staff bungalows, and a three room extension to the Guest House neared completion and will be a most welcome addition to our expansion.

There is always much maintenance work to be done on St. Coombs, which already approaches a small township in complexity, if the bungalows and roads are to be kept in a sound and presentable condition. Certain defects in some recently relaid roads gave rise to concern, and this matter was put into the hands of experts for guidance.

Inside the laboratories an extensive modernisation was started in the Administration, Plant Physiology and Entomology Sections. This has entailed extra work for the officers concerned, but when completed the Institute as a whole will be able to take pride in a very fine set of laboratories and offices.

Conclusion.—Given patient co-operation from the tea industry we are convinced that we shall soon be able to reverse the rather depressing picture presented by the events of 1957. Speedy action is necessary, for already the strain of the depletions has been felt by those officers who have had to carry out more than their normal duties, and there is a limit to personal endurance.

J. A. H. TOLHURST,
Acting Director.

REPORT OF THE AGRICULTURAL CHEMIST FOR THE YEAR 1957

A. AGRICULTURAL CHEMISTRY

Staff.—The senior officer relinquished duties as Acting Director in February, on the return of the Director from furlough, but towards the middle of the year he was required to turn his attentions once again to administrative matters, prior to resuming the Acting Directorship in September, for an indefinite period. The one-month visit of Prof. F. Hardy, in April, provided another, albeit highly appreciated, diversion from the main task of developing the previously established lines of research.

At the end of the year interviews were held to strengthen the staff establishment of the Section, and as a result it is hoped to appoint a Research Assistant and a Technical Assistant Grade I early in 1958. As will be seen from the following report, an increase in staff is urgently required if further dislocations in work are to be avoided.

General.—In view of these difficulties it could not be expected that the Section could produce a normal report on research progress in 1957. One of the senior assistants was diverted to the Biochemistry Sub-Section, while the other after completing certain series of analyses, turned his attentions to the control of established recording instruments and to the setting of additional apparatus. The Section now possesses an extremely valuable collection of instruments which, over the years, will provide systematic information on certain aspects of soil conditions in relation to what may be described as "inter-row microclimatology." By which we refer to the impact of human and climatological forces on the strip of soil between the bush rows, as opposed to that area of soil more or less permanently protected by the frame of the bush. Operations in bush management and soil cultivation have a large effect on a comparatively small proportion of the soil, but as this proportion constitutes, we believe, the most active zone in a tea field, we are naturally concerned to investigate its chemical and physical properties as thoroughly as possible. We already have soil thermographs installed over a wide range of climatic conditions in the tea growing areas, and the only factor preventing a similar extension of the other, more complex, instruments is the lack of the field staff and sub-stations which would be necessary.

Field manurial experiments suffer similarly from the absence of field staff in this section and with the virtual withdrawal of the senior officer from this work we had no option but to abandon much of the programme. The experiments conducted in conjunction with Sapumalkande and Abergeldie Estates continue, and again we express our sincere thanks to these estates. It was noted that trends of increasing yield began to appear on the "high potash" treatments in the Sapumalkande experiment on young seedling tea. These trends are as yet nowhere near statistical significance, but it will be interesting to see if they increase throughout subsequent pruning cycles. Again we would emphasise our conviction that response to a manurial treatment cannot be

judged over one pruning cycle or less. Even though an effect may be detected in a short period, as may be expected from certain treatments, the real evaluation must cover at least one recovery from pruning and subsequent progress to the end of that cycle, where the cycle prior to this had already been under the experimental treatment. This is understandable enough, but we are sometimes expected to give an answer to questions on the effectiveness of manurial treatments within an impossibly short time. Ideally, we should be starting experiments now, to give an answer to questions which may arise ten years hence. With a really comprehensive series of adequately designed experiments under strict control, we could approach closely to this aim without having to rely unduly on prophecy.

Visit of Professor F. Hardy.—Professor F. Hardy's visit in April could hardly have come at a more opportune moment, since, for reasons already stated, the Section of necessity had to re-adjust plans for the near future. Therefore the advent of on-the-spot advice from such an authority on tropical soil chemistry was doubly welcome. Consideration of the research programme promoted by the Chemist within the last three years was taken side by side with suggestions for future development.

During these four weeks Professor Hardy and the Chemist paid many visits to selected estates, covering the wide range of climatic conditions found in our tea growing areas, and also the rather narrower range of geological formations which may affect the soil thereon. This was a strenuous undertaking and its success was due to the energy and enthusiasm which Professor Hardy put into the task. As a result, we were reassured as to the possibility of the existing research programme on the factors affecting certain fundamental soil properties over the whole geographical range concerned in tea growing. Other salient features of Professor Hardy's comments, which were collected into a very extensive report, were as follows:—

1. The great water stability and lack of erodibility of our tea soils in general, was noted with surprise, by comparison with many soil types in two continents which had come within his experience. This must not of course, be taken as an excuse for careless handling of soils on very steep slopes. In such conditions if soil is subjected to violent disturbance the Law of Gravity must be expected to determine its movement downhill.

2. In spite of the physical stability of exposed soil, he was most emphatic that the soil surface should never be exposed for longer than was absolutely unavoidable. Degeneration of microbial soil populations followed exposure very rapidly, and subsequent planting, in the tropics, was often found to give poor results for many crops. A suggestion was offered that gliricidia, planted very densely, might prove of value in rehabilitating low elevation soils over a short period.

It will be appreciated that the general points brought out in these two sections confirm the Institute's recommendations published in recent years.

3. Professor Hardy further emphasised the need for field manurial experiments to be not only long term and established over all the representative tea areas, but also to be designed in conjunction with other sections particularly Physiology. With this we are in complete agreement. Division of research into arbitrary compartments is conducive to efficient working only so long as co-operation is forthcoming when the time comes to "put the question to the tea bush in the field", to quote an oft repeated dictum of Professor Hardy. Segregation of scientific divisions is not recognised in the struggle for existence

surrounding the plant in the field. It has long been felt that, for a crop such as tea which is subject to a continual and complex system of management, manurial experiments conducted in "splendid isolation" and independent of physiological considerations, in particular, could only be of restricted value. We believe that the Physiologist would agree that the converse is true, and also that a readjustment of staffing would be necessary to achieve the desired end.

B. BIOCHEMISTRY

Staff.—We have continued the temporary arrangement whereby the work of this Sub-Section has been conducted by Mr. M. S. Ramaswamy under the guidance of the Agricultural Chemist. As there was no technical assistant, it was decided to transfer one of the agricultural chemistry staff, as far as certain routine work allowed.

General.—To a lesser extent the difficulties mentioned above have affected our estimate of the future research development of this Section also. Schemes are at present under discussion, and it will only be said here that we envisage a division of the present programme into two complementary groups. One would deal with the chemical processes occurring during manufacture, while the other would concentrate on the chemical composition of the flush as affected by field conditions. This would appear to be a very necessary development and, of course, its implementation would require a greatly increased staff.

New Developments in Processing.—From time to time changes have been suggested in methods of manufacture, and very recently several firms have paid attention to the production of a soluble solid, prepared from tea infusions, which is capable of being re-dissolved in water with the minimum of trouble. Methods, and results, naturally vary and it is not for us to comment on techniques or on characteristics of these "soluble teas."

Our interest has been aroused by one particular method which appears to offer scope to a biochemist as opposed to a technologist, and we are glad to realise that our existing programme, with its emphasis on enzyme activity under varying nutritional and physiological conditions, will cover many of the problems likely to arise in the processing.

Leaf Biochemistry.—CHLOROPHYLL.—A detailed study of the application of the standard method for the determination of chlorophyll components *a* and *b* using the Beckman Spectrophotometer was carried out with a view to modifying the procedure for tea leaves. It was found that small quantities of leaf material, in the region of 50 mgs. could be utilised and variations in the chlorophyll content in different areas of a single leaf blade could accurately be determined.

A typical example of the variations in two halves of a single leaf is given below:

	1st Half	*2nd Half*	*Difference*
Total chlorophyll mgs/gm dry leaf	7.26	7.30	0.04
Chlorophyll *a* „	5.48	5.42	0.06
Chlorophyll *b* „	1.78	1.88	0.10
Moisture %	62.5	62.8	0.3

The chlorophyll content of parts of tea flush, clonal material, leaves of different maturity in healthy and chlorotic bushes, clones treated and untreated

with copper fungicides, and tea during various stages of manufacture was determined. The chlorophyll content of tea leaves increases with age, mature leaves containing the maximum amount. The chlorophyll content of flush in a single clone of chlorotic and non-chlorotic bushes does not differ materially, but mature leaves show marked differences. During manufacture chlorophyll appears to decompose mainly during firing. Treatment with copper compounds increases the chlorophyll content of tea leaves both under laboratory and field conditions.

Tea Pectins.—Tea pectins can be fractionated into three main groups depending upon their solubility in water, oxalic acid and ammonium oxalate. These constituents appear to play an important role during the fermentation of tea and they are also likely to affect the liquoring characteristics of made tea. Preliminary work indicates large variations of these fractions in different parts of the tea flush. One of the components of enzymic hydrolysis of tea pectins during fermentation is methyl alcohol. A modification of Wakeley and Black's method for carbon estimations in soils has been found to be satisfactory for its estimation.

Fermentation of tea.—Preliminary experiments have indicated the possibility of the use of the Beckman Spectrophotometer for determining small differences in the degree of fermentation, the evaluation of which is, at present, not precise.

Nitrogen content of flush fractions.—A comparison between the total nitrogen content and caffeine of flush fractions appears to indicate that the main source of the nitrogen is caffeine. No significant variations were found in bud, 1st leaf and stalk of flush plucked at different periods of a day during bright weather conditions; but nitrogen increased in the 2nd and 3rd leaf as the day progressed. Variations were found in all flush fractions plucked on different days.

Soil Biochemistry.—The effect of soil pH on the mineralisation of organic matter.—Tea soils (top 6") drawn from different elevations were treated with lime or sulphuric acid to shift their pH to 4, 5, 6, 7 and 8. The buffering capacity of the S.W. Monsoon zonal soils appeared to increase with elevation. Incubation studies showed that there was a tendency for the pH to revert to normal in most of the soils. The optimum level of moisture content for nitrification varied with the different soils. A shift in pH towards alkalinity generally increased nitrification. Ammonification was very poor in most of the soils and the ammonia content decreased as the pH increased.

Alternate wetting and drying of soils.—In an attempt to determine the maximum degree of mineralisation of soil organic matter by alternate wetting and drying of various soils under laboratory conditions, it was found that depending upon the elevation at which the soil was sampled, the coversion rate varied from 4 to 28 per cent of the initial nitrogen content after about 45 treatments. The conversion was mostly to ammonia. Incubation studies showed that most of this ammonia was converted into nitrate by the nitrifying organisms.

Publications.—Three more papers under the heading "Studies on the Fermentation of Ceylon Tea" were published in the Journal of the Science of Food and Agriculture, Volume 9, pages 43 to 56.

Part IX. A preliminary Investigation of the Volatile Constituents of Tea Leaf. J. Lamb, M. S. Ramaswamy and V. Mendis.

Part X. Pectic Enzymes in Tea Leaf. M. S. Ramaswamy and J. Lamb.

Part XI. Relations between the Polyphenol Oxidase activity and Pectin-Methylesterase activity. J. Lamb and M. S. Ramaswamy.

Miscellaneous.—On completion of the main reservoir dam, water samples from different depths were drawn for chemical analysis. The high oxygen absorption values and albuminoid nitrogen contents observed are probably derived from the decomposition of the leaves of the submerged tea bushes. It was suggested that the stored water should be drained out as frequently as possible during the monsoon season to replenish the reservoir with fresh rain water.

J. A. H. TOLHURST,
Agricultural Chemist.

REPORT OF THE TECHNOLOGIST FOR THE YEAR 1957

Staff.—Mr. K. Sothisrihari was appointed as Technical Assistant in this division on 9th September. By his appointment a long felt need has been supplied since for many years the Technological section was staffed by the Technologist and only one assistant, namely Mr. S. M. Guneratnam.

Advisory.—83 visits were made to factories, the highest ever recorded. Of these Mr. Guneratnam was responsible for 36.

Many of these visits yielded fruitful results, chiefly because the recommendations made were carefully implemented. In most cases the cause of unsatisfactory prices was traced to underwithering partly brought about by inadequate withering accommodation and partly resulting from the view still held by some that the indispensable condition for coloury liquors is soft withers. The importance of having the right wither for successful manufacture has been stressed over and over again in our publications and Superintendents are requested to look into this matter first before seeking the advice of the Institute when they are not satisfied with their tea prices.

Clonal manufacture.—(*a*) Technique.—A considerable number of experiments were carried out to determine the technique that would make the best of the leaf on a miniature scale. This was essential in view of the future programme envisaged for a study of the characteristics of various clones. Despite modifications in the design of roller tables and in rolling technique it was not possible to obtain a tea of the same standard of appearance normally associated with commercial manufacture. Nevertheless a suitable system was developed to produce a liquor which though inclined to be greenish was not abnormal. It is inevitable that so long as there is no heat development in the rolling of small quantities of leaf and inadequate pressure to rupture all the cells a certain amount of greenness would be present in the liquors. This shortcoming has therefore to be ignored unless it happens to be pronounced. Otherwise miniature scale manufacture was not found wanting in bringing out the inherent properties of a clone.

(*b*) Characteristics.—Clones Nos. 2024 and 777 continued to produce teas of very good quality so much so that on one occasion one taster remarked "we have had some difficulty in valuing these teas as there is nothing approaching their quality in the market."

One significant feature of clone No. 2024, when manufactured on a larger scale, was not only the very high percentage of O.P. obtained, but also its standout appearance. The grade received very favourable comments from the tea-trade in Colombo and was considered one of the finest samples of O.P. ever seen.

In contrast No. 777 produced teas poorer in leaf appearance but with about the same quality as No. 2024.

Blends of these two clones came out better than either clone, and whether they were blended before or after manufacture apparently made no difference to the result.

Two other clones were also studied. One of these, a higher yielder, No. 2016, somewhat similar in its tea-making properties to clones 2021, 2022 and 2025 was found to be inferior to No. 2024 in all respects and also greener in character.

The other was clone No. 26 (coloured flush), which was selected for its remarkable coloury liquor. It was hoped to utilize this special feature for blending purposes but its very plain and coarse liquor was a disadvantage. Whether in a blend of a large number of clones, clone No. 26 would make a valuable contribution to colour without lowering the quality of the blend, it is impossible to say.

In the circumstances selection of clones for planting on a large scale should be made on the basis of individual quality with due consideration to other properties which affect the market value of a tea in the district in which they are grown.

The peculiar astringent property of clone No. 2024, unusual for Dimbula teas, was the subject of some study. Various rolling techniques and different periods of fermentation failed to introduce a mellow character to the clone.

(*c*) T.R.I. CLONES GROWN IN THE UVA PROVINCE.—Five clones were examined during the period September to October, and compared with some of the best Uva's offering at the time and with the teas produced from the estate in question. Average valuations of six Buyers and two Brokers were as follows:—

		1st manufacture	*2nd manufacture*
Clone No. 1294	...	Rs. 4/06	Rs. 3/46
,, ,, 777	...	,, 4/05	—
,, ,, 1526	...	,, 3/80	,, 3/97
,, ,, 2024	...	,, 3/44	,, 2/80
,, ,, 1114	...	,, 2/28	,, 2/20
High grown average	...	,, 2/51	,, 2/35
Estate tea	...	—	,, 2/25

(Note:—The grade reported on in every case was B.O.P.—average outturn of about 65 per cent).

Except for No. 1114, all the clones were superior to normal estate manufacture. The results closely agree with those obtained from the same clones grown at St. Coombs, the only exception being No. 2024. The best of the lot was No. 1294, which was described in the following terms:—"Bright infusion, strong, pungent liquor with very good quality and flavour, little colour but an excellent clone."

(*d*) CLONES FROM DIFFERENT ESTATES.—41 clones were manufactured for 12 estates, and it is regretted that in some instances requests for quality tests had to be refused because the material to be tested failed to fulfil the requirements of a quality test. Attention is invited to this aspect of our work in our Annual Report for 1955—pages 37 and 38, and it would be appreciated if estates wishing to have clones tested would observe the conditions stated.

High temperature fermentation.—Further work was carried out during the second half of the year on the effect of temperature of fermentation on *commercially* rolled leaf. Fermentation at 80°F and 90°F was compared with that at room temperature (of about 70°F). The results can be briefly summarized as follows:—

(*a*) Temperature of 90°F.—(1) *Equal periods.*—There was a slight improvement in colour with perhaps a slightly adverse effect on strength. Quality was worse, and the tea on the whole was inferior.

(2) *Shorter periods.*—Colour was about equal to that at room temperature. There was practically no change in strength, and quality was not improved. The tea was still inferior.

(*b*) Temperature of 80°F.—(1) *Equal periods.*—The colour difference was not so marked as at 90°F, but the gain in colour was accompanied by a loss in quality.

(2) *Shorter periods.*—Quality was still below standard.

In view of the tendency towards greenness for the shorter periods there would have been no advantage in shortening the time of fermentation still further in order to preserve quality.

Amongst the other observations made on the teas in 57 experiments carried out it was noted that:

(1) When teas were lacking in quality variations were not so great.

(2) On one or two occasions when flavour was present in the leaf it was lost at the higher temperatures. (This is to be confirmed during the dry weather period in 1958).

(3) Strength tends to decrease on extending the fermentation at higher temperatures.

(4) Shortening the period of fermentation by half an hour at higher temperatures gave more significant results than at room temperatures. Difference in colour and quality was more noticeable whereas at room temperature it was not so marked.

(5) The development of colour at a higher temperature is accompanied by less quality, thus proving once again the very close relationship which exists between these two characteristics.

It may be concluded from these results that nothing is likely to be gained from raising the temperature of the air in fermenting rooms unless it is well below 70°F. If rolling has been efficiently carried out there is no need to continue fermenting the dhool at the high temperatures normally attained during rolling.

The L.D.S. system of manufacture (leaf-thermac—drum storage—single unit system).—This system which is sponsored by the Foundation for Improved Manufacture of Tea, Utrecht, Holland, is a radical departure from current practice, the essential feature being that all the manufacturing processes are carried out in a single drum. It is claimed by the sponsors of the scheme, who have issued an elaborate publication on its technical details, that because of the fully controlled conditions optimum quality can be obtained.

The scheme merited investigation and preliminary research was done in the first instance to establish that weight and appearance of the tea would not be adversely affected by the proposed new method of rolling leaf. We were very fortunate in obtaining a ball-mill of the required size from the Ceylon Institute of Scientific and Industrial Research, who were kind enough to loan it for a few months.

All attempts to roll tea leaf in this ball-mill failed; the product was brownish, flaky and lacked weight. A certain amount of bruising took place, depending on the weight and size of balls used but for satisfactory cell rupture it was found necessary to prolong the period of 'rolling' and the result was a powdery mass of particles.

Whatever advantages the L.D.S. scheme may offer, the first stage in the new method of processing has a detrimental effect on appearance. Since a more satisfactory result can be obtained from a Clivemeare roller the L.D.S scheme has nothing in prospect at present as far as Ceylon tea is concerned. The time has not yet come for Ceylon to risk putting on the market teas of an unconventional character.

Stalk Extraction.—The Tarry Nipper is designed to extract stalk by the well-known principle of breaking particles of tea by the application of pressure. Since any such treatment has a greying and flaking effect the type of tea to be treated has to be most carefully selected. In any case the machine should not be used with the intention of increasing the outturn of the B.O.P.F. grade or in place of a cutter for the larger leaf in the earlier dhools. The machine is simple to operate but the greatest care should be taken in the regulation of pressure and thickness of spread.

Conflicting reports still continue to be received on the performance of the Japanese stalk extractor. The current impression is that its use results in thinner liquoring teas. If the machine is correctly used the liquors should show no difference from those after normal picking and winnowing. Experiments carried out at the Institute and elsewhere have shown that liquors are identical. Removal of small leaf with the stalk, as far as evidence goes, is the only probable cause of liquors being thinner. Like the Tarry Nipper the Japanese stalk extractor has a limited application, and by the indiscriminate use of such machines many estates are in fact gaining nothing by a saving in picking costs.

Moisture meters.—The Scotmec—Oxley Instantaneous moisture meter is a portable resistance meter for measurements on grain and the like in sacks. It works on the simple principle that electrical resistance varies with moisture content of the material. Moisture content is read immediately from a dial.

The adaptability of this instrument was considered for determining the moisture content of tea by altering the resistance. Tests conclusively proved that it was quite unsuitable for tea since it could not be relied on to give accurate readings at low moisture contents.

Mechanical handling.—The successful utilization of tubular conveyors for the handling of tea and other materials in industry suggested the possibilities of extending their application to rolled leaf. The main advantages of this system over other types are its flexibility in direction, one circuit, and the ability to discharge the material at any point. The scheme contemplated was to convey the bulk from roll-breakers to rollers.

Extensive tests were carried out by a well known firm in England on rolled leaf sent from St. Coombs. Although the leaf had only 50 per cent moisture it was found to be too sticky to be successfully conveyed.

Grading.—A Russell cascade machine based on the principle of gyratory turbulence and claimed to revolutionize all previous ideas on grading, was tested throughout the year. Various combinations of sieves were tried out but grades were not uniform. There was also a marked tendency for the mesh to get clogged with wiry leaf, thus making it more difficult to obtain even grades. Furthermore, since a set of at least 3 machines would be required under normal conditions in a factory, the Russell's machine has no substantial advantages to offer. One single machine might however have a limited application for the separation of fannings from dusts, but otherwise we can see no possibility of it superseding the type of vibratory sifter universally used.

Packing.—A question often raised is why the conventional plywood chest should continue to be used for the packing of tea when multiply bags and corrugated cases are being used all over the world today for every conceivable commodity.

Paper bags have been tried in the past for tea and the main disadvantages are:—

1. difficulties associated with sampling,
2. risk of damage during handling and transit,
3. danger of leafy grades being crushed,
4. no second-hand value.

A Company in the United Kingdom has already conducted experiments with corrugated cases of tea shipped from India but the tests were not completely successful. A modified type of container has since been introduced after discussions between the Technologist and the Company in question, and subjected to tests on a mechanical packer. A single liner case tended to bulge when tightly packed, making it difficult to bring the flaps at the top of the box together. To correct this a double liner is necessary, which then increases the cost of a package considerably. Other difficulties encountered with a card-board pack are:—

1. Vibration imparted is less than in the case of a plywood chest. Undue pressure has therefore to be applied for the case to hold the same amount of tea. This results in bulging of the sides.
2. Sticking of the flaps.
3. Strengthening of the package to withstand handling, etc.

These difficulties are being investigated with the co-operation of the manufacturers.

Miscellaneous.—(*a*) A plastic compound produced by the Ruberoid Company of London and recommended for repairs or resurfacing of fermenting tables was tested and found unsuitable. Being rather soft it is easily scored and therefore liable to harbour moulds and bacteria.

(*b*) A sample ash plywood chest made in China was found satisfactory for the packing of tea.

(*c*) A "Darvic" sheet supplied by Imperial Chemical Industries for use under roll-breakers has proved to be suitable.

(*d*) As in previous years taint tests were conducted for the Entomological and Pathological sections, on insecticides, acaricides and fungicides.

Acknowledgements.—Once again it is a pleasure to acknowledge the assistance the Technological division has continued to receive from the Tea Tasters in Colombo, to whom our grateful thanks are due.

E. L. KEEGEL,
Technologist.

REPORT OF THE PLANT PHYSIOLOGIST FOR THE YEAR 1957

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1. General.—Work started in September on the modernization and rebuilding of the laboratory rooms in the Pathology and Plant Physiology Sections. It is expected that the work will be completed by May 1958.

The Department received 1,210 letters and despatched 1,240 advisory letters. Approximately 90 visits were made by the staff for advisory and experimental purposes. 114,000 V.P. cuttings were sent to estates.

STAFF.—Mr. D. H. de Saram resigned his post as Officer-in-Charge of the Clonal Proving Station, Neuchatel, and Mr. H. B. Ratnayake was transferred to fill the vacancy.

2. Vegetative Propagation.—A large number of experiments were carried out during the year involving some 35,000 cuttings. An extensive account of the various trials will be published in 1958. A summary of the results is given below.

SOILS.—The soil used for propagation nurseries determines to a large extent failure or success. "Grass soil" (the top 6″ of an area planted several years in Guatemala grass) gave the best results because of its good structure and because it contained masses of undecomposed small roots providing good drainage. The results with "tea soil" (from tea fields) were disappointing in all instances. A good substitute where suitable soil is not available, was sieved "red sub-soil" mixed with peat litter and sand in equal proportions. During wet weather the nursery beds must be well drained and soils with a rather poor structure, like sub-soil, should be sieved beforehand and not pressed down.

It was again confirmed that rooting is impeded if the soils used for propagation are too rich in nutrients. However, manuring, *e.g.* at the rate of 1/2 to 1 oz. of Sterameal per 24 (basket) plants, monthly after the cuttings have rooted, was found to promote subsequent growth very considerably.

SHADING AND WATERING REQUIREMENTS.—It is our experience that unsuccessful rooting is often due to overwatering not seldom combined with overshading; the latter will also lead to retarded development of the axillary shoot. In general, the amount of light which can be allowed to prevail depends on the material used for shading and the amount and frequency of water application. For instance, with mist sprayers excellent rooting was obtained under a very light shade due to the fact that the leaves were kept wet most of the time. Both under up-country (Uva, Dimbulla) and low-country conditions shading with coir matting (1/4″ mesh) appeared to give as good or even better results than fern plants. The former material, though dearer, has the advantage that uniform light conditions are provided while allowing a better control of nursery operations.

During dry and sunny weather 0.25″ to 0.35″ of water given in one or two applications per day was found to give good rooting in beds shaded by coir. During showery or rainy weather watering is not required.

Water application by mist sprayers would be ideal but costs are likely to be prohibitive. For extensive nurseries an overhead sprinkler system would seem a possible and more efficient alternative than watering by hand.

Influence of leaf area of the cutting.—It appeared that "double-node" cuttings (with 2 leaves) had potentially greater root and axillary shoot growth than "single node" cuttings (1 leaf). However, the former are more sensitive to environment so that, *e.g.* under sub-optimal conditions of shade and/or watering, more double-node cuttings may succumb to scorch than single-node cuttings due to their greater leaf area.

"Half-leaf" cuttings (top half of leaf removed) rooted as well as cuttings in which the nodal leaf was intact, though subsequent root and shoot growth was found to be considerably less. Halving the nodal leaf has the practical advantage that more cuttings per unit area can be propagated. It also appeared that fewer cuttings developed flower buds; the latter cause stagnancy in axillary shoot development. Removal of flower-buds promoted subsequent root and shoot growth to some extent.

Removal or loss of the original (nodal) leaf after the cuttings have rooted and grown an axillary shoot may or may not reduce subsequent growth dependent on the leaf area of the axillary shoot at the time of removal.

Influence of leaf extracts.—In further trials on the effect of halving the nodal leaf or on its removal it was also investigated whether and to what extent such an effect could be attributed to the removal of specific substances with the leaf. Namely, Spiegel (Proc. 14th Int. Hort. Congress, Scheveningen. 1957: 239-246) found with cuttings of *Vitis* species that the leaves contained substances which inhibited growth.

Three experiments were carried out on this subject in which single-node cuttings of a good rooting clone (of the 20-series) were steeped in leachings or extracts in water of leaves, leaf parts or complete cuttings of both a good rooting clone (20-series) and a poor rooting clone (25). The cuttings steeped in the leachings were subsequently planted and assessed $2\frac{1}{2}$ months afterwards. All 3 experiments were carried out on a randomized and replicated basis allowing statistical analysis (10 $\times$ 10 cuttings/treatment).

I. In the first trial 50 gr. samples consisting of the basal, apical, left or right halves of leaves from clone 25 and 2025 respectively were shaken in flasks (in 250 ml. in water) for 5 hours. In each of the extracts (diluted to 800 ml.) thus obtained, 100 cuttings of clone 2025 were steeped (only stem submerged) for 24 hours and subsequently planted out. It appeared $2\frac{1}{2}$ months later that both rooting and axillary shoot growth of the cuttings steeped in the extracts was less, though not significantly, than that of the control (steeped in distilled water), irrespective of the leaf part used for the extracts. The cuttings steeped in the extracts of the poor rooting clone (25) gave less shoot growth than those steeped in extracts of the good rooting clone (2025) in all instances.

II. In the second trial cuttings of clone 25 and 2026 of which the nodal leaf was intact, reduced by $\frac{1}{4}$th (apex cut off), halved or completely removed respectively were steeped in 800 ml. water overnight (100/treatment). Subsequently fresh cuttings of clone 2026 were steeped in these leachings for 24 hours and planted out thereafter. At the time of assessment it was found that root and axillary shoot growth of the cuttings steeped in the leachings did not significantly differ from that of those steeped in water, irrespective of the leaf area and rooting capacity of the cuttings used for leaching purposes.

III. In the third trial cuttings of clones 25 and 2023 (100/treatment) were steeped during 1, 2, 4 and 6 days respectively in water. After that fresh

cuttings of clone 2023 were steeped for 48 hours in the thus obtained leachings. Assessment 2½ months later showed that root and shoot growth of the cuttings steeped in the leachings was better than that of the cuttings steeped in water in all cases, but the differences were not significant.

Also the cuttings of clone 2023, used to obtain the leachings, were planted in the nursery. It appeared that steeping of the cuttings in water up to 4 days had significantly increased root and axillary shoot development, as compared with the control (not steeped). Root and shoot growth of cuttings steeped for 6 days was not significantly better than that of the control.

The observations suggest that the leaf (and stem) of a cutting contains both growth promoting and inhibiting substances. However, it cannot be said with any certainty whether their effect is qualitative or quantitative. The relative small influence on rooting and/or shoot growth may indicate they are not readily extractable in water or that they do not play a dominant part in the growth processes of the cutting. It is difficult to explain why the growth of cuttings steeped in the leachings of other cuttings and the growth of the latter cuttings used to obtain the leachings was promoted in both cases (trial III). It is possible that the leached out "growth inhibitor" loses its activity in water quicker than the "growth promoter". Extracts obtained by vigorously shaking of the leaves presumably contain a greater quantity of inhibitor than extracts obtained by leaching, as the growth of cuttings steeped in such extracts was to some extent retarded (trial I.)

Influence of position.—The position of the cutting in the shoot from which it is taken was not found to have a great effect on rooting unless they were taken from a too mature or too immature part of the shoot. If the maturity of the shoot itself is not too advanced, "redwood cuttings" (from just below the green wooded part of the shoot) will root as well as "green-wood cuttings."

Effect of growth substances.—The experiments carried out to induce rooting in difficult rooting clones with the help of growth substances will be dealt with in some detail. These trials were carried out in replicate with clones 25 and 1076 and with 18 cuttings per treatment per clone (76 cuttings in total/treatment). Methods and treatments as well as a short indication of the average results for the two clones are given below.

(a) "*Quick dip method*".—The dipping of the cuttings in concentrated solutions (in 30% alcohol) of the growth substance. The following solutions were used:—

Control: 30% alcohol.

1, 2, 4 and 6 mg/ml IBA (3-indolyl butyric acid)
1, 2, 4 and 6 mg/ml NAA (a-naphthyl acetic acid)
1, 2, 4 and 6 mg/ml IAA (3-indolyl acetic acid)
1, 2, 4 and 6 mg/ml IBA + NAA (in equal parts)
2 mg/ml GA (Gibberellic acid)
2 mg/ml Ga + 1, 2, 4 or 6 mg/ml IAA

The best results were obtained with 2 mg/ml IBA (38% rooting), 6 mg/ml NAA (42% rooting), 4 mg/ml IAA (40% rooting), 4 mg/ml (40% rooting), 4 mg/ml IBA + NAA (42% rooting) as compared with 21% rooting for the control after 5 months. Lower or higher concentrations and other treatments had little or no effect at all.

Also three commercial preparations (Seradix 1, 2 and 3) were used, the compositions of which were unknown. Only Seradix 3 showed some effect giving 42% rooting as compared with 30% for the control.

(b) "*Powder dip method*".—The treatment of cuttings with commercial preparations (Stimurhiz) which consisted of a known quantity of growth substances on a basis of talcum powder.

The base of the cuttings was dipped in the following preparations.—

Control: Talcum powder

Stimurhiz A: 1% IAA
Stimurhiz AA: 1% IBA
Stimurhiz B: 0.2% NAA
Stimurhiz B + extra NAA: 1% NAA
Stimurhiz A + Stimurhiz AA: 0.5% (IAA + IBA)
Stimurhiz AA + Stimurhiz B: 0.5% IBA + 0.1% NAA
Stimurhiz AA + Stimurhiz B + extra NAA: 0.5% (IBA + NAA)
Stimurhiz A + GA: 1% NAA + 1% GA

It appeared that none of the above treatments gave better rooting than the control.

(c) "*Diluted method*".—In this case the cuttings were steeped in dilute solutions of the growth substances for 18 hours. The growth substances and concentrations used were the following:—

Control: water

20, 40, 60 p.p.m. IBA
20, 40, 60 p.p.m. NAA
20, 40, 60 p.p.m. IAA
20, 40, 60 p.p.m. IBA + NAA (in equal parts)
0.2, 0.4, 0.6, 20, 40, 60 p.p.m. DCP (2, 4 Dichlorophenoxy-acetic acid)
20 p.p.m. GA
20 p.p.m. GA + 20, 40 or 60 p.p.m. IAA

The best results were obtained with 60 p.p.m. IBA (41% rooting) and 40 or 60 p.p.m. IBA + NAA (30% rooting) as compared with 20% rooting for the control after 5 months. The other treatments had little or no effect.

Summarizing the experiments with growth substances it can be said that certain treatments increased rooting significantly. However, their effect was not spectacular as at best only about 40% rooting was obtained in comparison with 20% for the control after 5 months. Normally it takes not more than 6 to 8 weeks to obtain 100% rooting with untreated cuttings of a good rooting clone. It seems doubtful whether growth substances, even if more effective, could be efficiently used in practice as so many cuttings are needed for one acre (7,000 !).

Effect of Gibberellic acid.—This hormone was tried out in 3 trials with tea cuttings. It appeared that spraying of the cuttings between 2 and

6 weeks after planting with 10 or 100 p.p.m. GA had no effect whatsoever on rooting.

Spraying once or twice with 10, 100 and 500 p.p.m. respectively at the rate of 0.5 ml per plant shortly after the rooted plants were transplanted had no effect on the subsequent growth.

In a third experiment (non-transplanted) rooted cuttings were sprayed once or twice with 10 and 100 p.p.m. respectively at the rate of 1 ml or 2 ml per plant. All treatments showed an increase in elongation and leaf formation over the control, but the differences were not spectacular.

It is possible that more frequent spraying, *e.g.* weekly with 10 p.p.m. GA at the rate of at least 2 ml per plant, might have given better results.

3. Pre-pruning.—The above type of pruning, which has also been called "reverse rimlung pruning" was applied at Maliboda Estate for the first time by Mr. Fraser.

This method consists of taking away about 1/6th on each side of the bush along the rows at the time the bushes have reached the end of their pruning cycle. The remaining centre is pruned only after the "sides" have formed new shoots approximately 3"-6" long, which depending on elevation and weather conditions, takes about between 6 to 8 weeks.

Observations at Maliboda on pre-pruned estate tea seemed promising, especially in regard to the recovery of bushes thus pruned in the dry weather. Therefore the Institute decided to lay down replicated experiments to test the possibilities of pre-pruning on different estates: Downside, Gonakelle, (2 experiments), Endane (2 experiments), Welimada (2 experiments), St. Coombs (2 experiments). As not all experiments have been completed yet, only a summary of the main results will be given.

It appeared from the trials on the 4 outside estates that the loss of crop of pre-pruned bushes amounted to about 25 per cent as compared with non-pruned bushes. However, an interesting feature of side-pruning was the fact that the loss in crop tended to become less with consecutive plucks; by about the 7th pluck the yield of pre-pruned bushes was not much less than that of non-pruned bushes.

At St. Coombs where the bushes were of much denser growth at the end of their cycle than on the other estates, only the first few plucks after pre-pruning showed a loss of crop. Subsequent plucks of pre-pruned bushes yielded considerably more than those of unpruned bushes.

With regard to the time taken for the bushes to recover, it was found at St. Coombs, Welimada and Gonakelle Estates that pre-pruned bushes took 5 to 7 weeks less to come into plucking, as from the time their centres were pruned, than normally pruned bushes. Therefore, the smaller crop during the pre-prune stage is more than made good by the fact that such a bush starts to yield quicker after pruning. At Endane Estate it was observed that pre-pruning decreased subsequent die-back after the main prune when pruning was carried out during the dry weather.

It was also found from several trials that pre-pruning is only effective if the "sides" are allowed to grow new shoots of some size. If the main prune (of the centre) is carried out at the time the sides just show bud break, pre-pruning will have no favourable effect or may even be harmful.

With regard to yield it appeared that there was little difference between pre-pruned or normally pruned bushes once they came into plucking again.

Summing up our preliminary observations it would appear that pre-pruning not only can assist in a quicker recovery but probably also decreases die-back. It is expected that final results will be obtained by the middle of next year.

4. Bush Characteristics and Yield.—In view of the fact that the selection of high yielding clones (on the basis of yield assessments) takes a a great number of years, attempts have been made to find a single clonal characteristic which is strongly correlated with yield. That is to say, if such a characteristic could be found it could, when used as a selection criterion, much shorten the period needed to ascertain whether or not a certain clone is high yielding.

With a view to determining such a possibility, 20 or more clones of proven yield capacity were investigated to ascertain the correlation that existed between yield and:

(*a*) Growth rate of flush shoots

(*b*) Area of the individual mature leaf

(*c*) Total leaf area of the bush

(*d*) Pruning weight of the bush

(*e*) Banji production

(*f*) Number of "active internodes" of shoots developed after the bush is pruned (this denotes the internodes of which the axillary bud had developed into a side-shoot).

It appeared from these investigations that a significant correlation existed in cases (*a*), (*c*), (*d*) and (*e*), but the correlations were not very high (in the neighbourhood of 0.6). The correlation between yield and the area of the individual leaf was low and insignificant (0.23). With respect to the correlation between yield and number (percentage) of active internodes (*f*), our observations did not entirely confirm those of PORTSMOUTH (Tea Quarterly, 28/3, 1957: 21-30). In one case the correlation appeared to be non-existent (0.01) and in the other considerably lower (0.77) than that found by PORTSMOUTH (0.98).

Apparently, the yield is determined by more than one genetical characteristic. It would seem, therefore, that yield assessment for a shorter or longer time on 25 to 50 bushes per clone is the only practical and accurate method so far. A full account of the experiments will be published in the *Tea Quarterly*.

5. Long Term Field Experiments.—None of the field experiments on St. Coombs completed their pruning cycle during the year; the following experiments were in progress:—

(*a*) The three factor (N.P.K.) experiment in its 9th cycle.

(*b*) The "old" fish leaf plucking experiment in its 6th cycle.

(*c*) The "new" fish leaf plucking experiment in its 1st cycle.

(*d*) The thatching and manuring experiment in its 4th cycle.

(*e*) The phosphate quality experiment in its 3rd cycle. The results of the two previous cycles of this experiment were given in last year's annual report. It has now been modified by stepping up the original levels of phosphate to 15, 30 and 45 lb. P_2O_5 per acre respectively both for Saphos and Superphosphate.

PASSARA MANURIAL EXPERIMENT.—This is now in its 6th cycle. In this cycle as in the previous one the phosphoric acid applications are being omitted to observe the residual effects of the phosphate. (Addition of relatively high doses of superphosphate depressed the yield in previous cycles).

ENDANE EXPERIMENTS.—(*a*) *The manurial experiment* completed its first cycle (1½ years) in April 1957. The results for this cycle (given below) have not shown any significant response to the heavier dosage of nitrogen and/or potash so far.

Nitrogen and potash effects: yield in lb. made tea/acre/cycle.

	K 60	K 90	K 120
N. 80	2,351	2,357	2,348
N. 120	2,360	2,352	2,398
N. 160	2,393	2,350	2,337

In the second cycle which is now in progress calcium and magnesium treatments were included, the former being at two levels and the latter at three levels.

(*b*) *Pruning cycle* cum *plucking experiment.*—This experiment was laid down at the beginning of 1957. The following treatments will be compared:

(1) Pruning cycles of 1½, 2 and 3 years.

(2) Normal plucking versus fish leaf plucking, the latter preceded by 3/4 year normal plucking in order to enable the bush to form sufficient maintenance foliage.

(3) Two levels of manuring: one on the basis of 8 lb. nitrogen, the other of 12 lb. nitrogen per 100 lb. made tea.

DOWNSIDE CULTIVATION CUM PLUCKING EXPERIMENT.—The description of this experiment was given in last year's Annual Report. The yield data have not shown so far any significant trends.

6. Clonal Proving Stations.—(1) GONAKELLE, PASSARA.—(Total acreage of patna land about 34 acres). About 2 acres of the area cleared in 1955 and under Guatemala grass since 1955, were planted with 64 clones during the N.E. monsoon: 21 clones were from St. Coombs and 43 from 13 estates in Uva.

The Grevilleas planted as windbelts are growing satisfactorily but the growth of the Gliricidias is disappointing.

About 5 acres of patna land were cleared and planted with Guatemala grass. This area will be planted with clones in 1960.

The Meteorological Station was shifted to a new site selected by an officer from the Department of Meteorology as the old site was found to be unsuitable.

(2) NEUCHATEL, NEBODA.—The whole area of rubber and marsh land is 25 acres. The block of clones planted in 1956 was given a light prune and would probably be brought into plucking towards the middle of 1958. Some of the clones appear to be mixed and their origin too is dubious.

Cuttings of 15 new clones were planted in the nursery; 42 clones were put in multiplication plots. Of the 42 clones put out, 11 were from St. Coombs and the rest from 32 estates in the low-country.

The growth of the clones planted in 1956 and 1957 is not vigorous. This is probably due to the sandy nature of the soil. Attempts are however, being made to increase the organic content of the soil by the growing of suitable cover and bush manure plants and thatching.

(3) Enselwatte, Deniyaya.—(The extent of the multiplication block is 7 acres of virgin jungle).

The test plots were planted with 43 clones towards the end of the year.

There is ample nursery space in the clonal proving station for testing any promising clones and accordingly we shall be glad to accept clonal material from estates.

Acknowledgements.—The co-operation of Superintendents of estates who have offered clonal material for trials on St. Coombs, Gonakelle, Neuchatel and Enselwatte is gratefully acknowledged. We also thank the Managers and Assistants of Downside, Endane, Enselwatte, Gonakelle, Neuchatel and Welimada estates for all the assistance they have given us during the year.

T. VISSER,
Plant Physiologist.

REPORT OF THE ACTING PATHOLOGIST FOR THE YEAR 1957

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1. General.—Staff.—The Pathologist, Mr. B. N. Webster, resigned from his post in January and left the service of the Institute on May 21st, and Dr. T. Visser, Plant Physiologist, was appointed to act as Pathologist in addition to his normal duties. Mr. N. Shanmuganathan was appointed Research Assistant on 1st June.

Mr. S. Raju was released from temporary employment on 1st April having been appointed Conductor on Mattakelle Estate. Messrs. S. D. Richard and C. S. Jebamalai were employed on a temporary basis for work on blister blight experiments from 1st April.

Advisory.—678 letters were received and 611 letters despatched during the year. In total 259 consignments of diseased specimens were received for disease identification and report, while 2,915 soil samples were examined for parasitic eelworms. A number of 40 advisory visits was made by the staff of the Department. Mr. B. N. Webster addressed two meetings of District Planters' Associations.

2. Blister Blight Trials.—Field trials carried out during the North East monsoon of 1956-57 at Waldemar Estate, Udapussellawa, confirmed the findings of earlier experiments that 3 oz. per acre of a standard 50% copper fungicide can afford reasonable protection throughout all but the worst period of the monsoon.

In trials at St. Coombs, during the South West monsoon season of 1957 12 fungicides were tested for the control of blister blight on tea in plucking, at rates varying between 3 or 4 oz. and 6 or 8 oz. per acre per round. The monsoon, judging from the past 10 years, was somewhat less severe than average. It appeared again from the results that there was little to choose between the the copper oxides and the copper oxychlorides, as *Perenox* (50% Cu) and *Copper Sandoz* (50% Cu) at 6 oz. on the one hand and *Cupravit blue* (35% Cu) at 8 oz. and *Shell Copper* (50% Cu) at 6 oz. on the other, gave equally efficient protection. Also spraying of these fungicides at 3 oz. or 4 oz. per acre throughout a moderately severe monsoon afforded satisfactory protection in most instances. Contrary to earlier findings it was found that Bayer's *Red Copper* (70% Cu) at 6 oz. compared favourably with Perenox at the same rate.

Cobredon (45% Cu) applied at 6 oz. was again found to give as effective or nearly as effective protection as Perenox. The same held true for *Colloidal copper* (26% Cu) at 6 oz. which gave protection as good as Cobredon and only slightly less than Perenox, notwithstanding its much lower copper content.

Contrary to the conclusions drawn from the 1956 trials the 12% coated oxychloride *Fitox*, which was later replaced by a 16% formulation, did not give satisfactory protection. None of the three organic fungicides tested, *Phthalic* 4444*A*, *Flit* 406 and *E.F.* 250 gave satisfactory protection at 8 oz. when compared with a 50% cuprous oxide at 6 oz.

The protection afforded by *Bordeaux mixture* (25% Cu) at 8 oz. per acre was reasonably good, but less than that of 6 oz. of a standard 50% copper fungicide.

That, in general, the copper content of the fungicide applied determines the level of protection was demonstrated in one of our experiments from which it appeared that:

8 oz. Bordeaux mixture (2 oz. Cu) was equivalent to 4 oz. Perenox (2 oz. Cu) and 4 oz. Bordeaux mixture (1 oz. Cu) was equivalent to 8 oz. Fitox (1 oz. Cu).

The total yields of the sprayed plots over the period concerned varied insignificantly in most cases irrespective of the fungicides applied or their rates of application. Thus the yields gave hardly any reflection at all of the differences in foliage protection achieved by the different treatments. The loss in crop of the unprotected plots averaged about 16% over the monsoonal period in comparison with protected areas.

The usefulness of a practical system of forecasting the severity of blister blight infestation has been realised, with a view to reducing the costs of spraying without serious risks.

A full description and the results of the 1957 blister blight trials will appear in the next issue of the *Tea Quarterly*.

3. Red Rust.—The Research Assistant who visited a number of estates in the low-country reports that the disease was fairly prevalent on those estates, but not so serious as to cause alarm. The disease appears to be one of weak bushes and all indications are that with improved cultivation the disease could be controlled. It is thought that this algal parasite (*Cephaleuros parasiticus*) could be a contributory factor towards the low-country rim-lung chlorosis.

Artificial inoculations with red rust spores were carried out in the laboratory with a view to studying the mode of infection, symptoms, etc. of this parasite. Potted plants inoculated with red rust spores have failed to produce any symptoms. The experiments have to be repeated under low-country conditions. Anatomical investigations reveal that the alga lives only in the outer tissues of the stem and that it could be shed by exfoliation of these tissues. Measurements of spore dimensions indicate that the leaf and the stem-form are one and the same.

4. Wood-Rot.—The wood-rot observations in the mid-country (on Hayes Group 3,000 ft. elevation) were continued in 1957. The data obtained from 4 assessments on a replicated trial are presented in the table below. This table gives the total number of branches per 400 bushes which showed either "plain" die-back or die-back associated with shot-hole borer galleries.

Treatment	Die-back "S.H.B."	Die-back "plain"	Total
Pruning cuts protected Plots shaded	488	48	536
Pruning cuts protected Plots unshaded	367	53	420
Pruning cuts unprotected Plots shaded	420	45	465
Pruning cuts unprotected Plots unshaded	409	29	438

The above data again confirm last year's observations that die-back and shot-hole borer seem to be associated phenomena. However, as practically all branches of a bush are affected by shot-hole borer, it is difficult to say whether die-back is solely caused by this pest or whether there are other causes (*i.e.* sun scorch) for it. The results also indicate that the protection of the pruning cuts (with Skene's pruning mixture) has no effect on die-back incidence. As the layout of the experiment does not allow statistical analysis it is not certain whether the differences between the shaded and unshaded plots are significant.

It is likely that successful control of shot-hole borer will reduce die-back in the mid-country.

II. With regard to wood-rot in the low-country, observations are being made on Endane Estate, Kahawatta. As the findings published in the 1956 Annual Report indicate that the die-back prevalent in the low-country is almost exclusively "plain" die-back, an experiment was laid down to ascertain whether and to what extent the method of "bringing into bearing" affects the occurrence of die-back. For that purpose the following treatments will be compared:—

1. Thumb-nailing of the main stem and all subsequent side branches (at about 6-8 leaves) until in bearing.

2. As treatment 1 for 12 months, then cut across at 18".

3. Bending over when sufficiently large, followed by two cuts across at 12" and 30" (as practised on Endane).

4. Bending over, followed by thumb-nailing, as in treatment 1.

5. Centering at 2", followed by cutting at 4" and 8" and then tipping in.

Two manurial treatments will be applied *viz.* normal T. 180 and T. 500, and the high potash variants of these as used on Endane.

Part of the treatments have been completed and examinations of die-back and wood-rot will be made periodically.

Also assessments in 6 pilot plots of 20 bushes each were done on a field in plucking on Endane Estate. The observations on these bushes, which were brought into bearing by layering and subsequent cut-across revealed that plain die-back was negligible.

It would seem that control of wood-rot will lie in the direction of improved bush management, rather than in a fungicidal approach.

5. Phloem Necrosis.—The grafting trials carried out at Eskdale nursery, Kandapola, were not a success. On account of the unusual dry weather experienced at this place the percentage of "take" of the grafts was very low. Experiments to ascertain whether the virus of phloem necrosis is seed-transmissible have been commenced. Seeds were collected from necrotic bushes and put out in sand beds. About 60% of the seeds germinated and observations to date show no symptoms of necrosis.

6. Nematology.—The selection of eelworm tolerant (or resistant) clones continues. Data on the pot experiments with different clones are not yet available as the sampling has not been completed.

With regard to *fumigants*, trials with "Nemagon" were carried out on 5 estates. It was found that fumigation with this compound at a rate of 8 to 10 gallons per acre reduced the original population of eelworms by about 90% for some months after fumigation. From the 7th month onwards the population was found to increase gradually again.

These data indicate that fumigation might have to be carried out annually or at least biennially in order to be effective. However, economic control at present is not possible as the costs per acre are prohibitive. With Nemagon, the only fumigant available at present, which is not phytotoxic at recommended rates, the cost would be in the neighbourhood of Rs. 800/- per acre. Unless a very much cheaper method of chemical control is found, the only alternative would seem to be biological control and/or different agricultural practices.

Towards the end of this year experiments were set up with certain species of Marigold (*Tagetes* sp.) which have been found to be very effective in controlling eelworm in trials in Holland. From preliminary observations on pot experiments it appeared that the population of *Meloidogyne* species (Root-knot eelworm) was brought down from 115 to 2 eelworms per sample, 4 months after the sowing of marigolds. In the pots with *Tephrosia vogelii* the original population decreased only from 154 to 56 worms per sample. The *Pratylenchus* population (Meadow eelworm) had not yet been affected by either treatment.

A field experiment on Mount Vernon Estate started in December indicated that Marigolds ("local variety") sown as a cover crop in between the tea after pruning had considerably reduced both the *Pratylenchus* and *Meloidogyne* populations 6 months later. It may be that Marigolds provide a cheap means of obtaining some control of eelworms, while serving as a cover crop at the same time. However, more experimental evidence is needed.

Nursery.—Fumigation trials carried out at Gouravilla Estate, Upcot, with 3, 4 and 5 gallons of Nemagon per acre indicated that 5 gallons of this fumigant gave an effective kill, in accordance with our earlier recommendation.

Rehabilitation Trials.—The results of the rehabilitation trials carried out on Dambatenne Estate, Haputale, have been inconclusive. The following four treatments were applied: (1) Complete fallow, as far as is possible; (2) Growing of Guatemala Grass with incorporation of loppings; (3) Heavy applications of pig manure compost (20 tons per acre), and (4) replanting. The reduction in eelworm population at the end of about 18 months was highest in the Guatemala grass plots followed by the replanted, fallow and compost plots, in that order.

T. VISSER
Acting Pathologist.

REPORT OF THE ENTOMOLOGIST, FOR THE YEAR 1957

General.—Mr. D. Calnaido, B.Sc., was appointed Research Assistant and assumed duties on 1st May. Mr. E. F. W. Fernando joined the entomological division as Technical Assistant from 1st December. Mr. J. I. H. Bandaranaike was employed as a temporary field assistant right through the year. The rest of the staff remained unchanged.

Advisory.—The total correspondence dealt with during the year amounted to 1,540 letters of which 759 were received and 781 despatched. The number of consignments of specimens received for examination and report was 165. The majority of these referred to tea mites and Nettle Grub.

The staff was called upon to make 92 estate inspections; while 29 of these visits were of an advisory nature, 63 were in connection with experimental work on various estates.

The entomologist addressed 4 district Planters' Association Meetings, while the Senior Assistant, Mr. Ranaweera, conducted 3 demonstrations *cum* talks on tea mites at meetings of the Rakwana, Deniyaya and Maskeliya sub-district Planters' Associations.

All reported outbreaks of insect pests and mites are tabulated below together with the provinces in which they occurred. With the exception of the Bark-eating borer, *Indarbela quadrinotata*, which was confined to *Albizzia (moluccana) falcata* only, all the remaining pests were on tea.

Table A.—*Distribution of some insect pests and mites during the year* 1957.

REPORTED OUTBREAKS:	PROVINCE			
	Central	Uva	Sabara-gamuwa	Southern
Army Worm (*Prodenia litura* F)	1	0	0	3
Bark Eating Borer (*Indarbela quadrinotata Walk*)	5	0	0	1
Brown Bug (*Saissetia coffeae* Walk)	3	2	0	0
Green Bug (*Coccus viridis* Green)	1	4	0	0
Lobster Caterpillar (*Stauropus alternus* Walk)	1	2	2	0
Low-country Termite (*Glyptotermes dilatatus* Bugnion and Popff)	—	—	1	1
Lygus Bug (*Lygus viridanus Motsch*)	11	1	0	0
Nettle Grub (*Natada nararia* Mo)	1	31	0	0
Purple Mite (*Calacarus carinatus* Green)	3	1	0	1
Red Borer (*Zeuzera coffeae* Nietn)	3	4	0	1
Red Spider (*Oligonychus coffeae* Nietn)	8	4	3	1
Scarlet Mite (*Brevipalpus australis* Tucker)	9	10	3	0
Scavenging termites (*Termes spp.*)	4	—	4	2
Shot-hole Borer (*Xyleborus fornicatus* Eich)	11	2	3	3
Tea Tortrix (*Homona coffearia* Nietn)	13	1	0	0
Up-Country Termite (*Calotermes militaris* Desn)	3	—	—	2
White Grub (*Anomala* sp.)	3	5	2	0
Yellow Mite (*Hemitarsonemus latus* (Banks) Ewing.	19	7	2	0

Lygus bug (*Lygus viridanus* Motsch).—Enquiries relating to damage caused by this insect continue to be received from estates in the Dimbula and Dickoya districts. Damage is frequently mistaken for Cercosporella disease and on occasions even attributed to Tea Tortrix ! To Mr. Calnaido the Research Assistant was allocated the enquiry into the bionomics of the bug. A general observation made during preliminiary investigations was that the bugs are more rampant in fields which are not clean weeded. An experiment was therefore laid down on an estate in the Hatton district to test the accuracy of this observation and at the same time compare the effects of clean weeding against spraying with DDT as a measure of control. Though results were not conclusive, the experiment will be repeated in an amended form. Hitherto the application of a 50 per cent DDT dispersible powder diluted in the proportion of a pound in 25-30 gallons water and applied at the rate of a 100 gallons per acre has been found satisfactory: but 2 to 3 applications of the spray, at weekly or fortnightly intervals, are necessary for effective control.

Termites.—Further investigations into termite problems both up-country and in the low-country, as envisaged in the report for 1956 did not materialise. But an estate in the Maskeliya district very generously offered one of its worst fields affected with *Calotermes militaris* for a continuation of the insecticidal trials made in 1956. A preliminary survey was necessary to ascertain the number of affected bushes likely to be available for the trial. The assessment was made by a member of the entomological staff in co-operation with an Assistant on the estate. The results were illuminating and gave support to the findings of Redman King and Ranaweera in 1937, that less than 5 per cent of 28,000 bushes examined contained living *Calotermes militaris*.

The following data were gathered last year.

Total number of bushes examined		...	2,251
Bushes infested with *C. militaris*		...	37
Per cent bushes infested	...	...	1.6

Glyptotermes dilatatus has been found in bushes reported to have been killed by shot-hole borer ! Such bushes are invariably infected with Ustulina root disease. Since the termite is known to feed upon both dead and living tissue it is a moot point as to whether the disease follows the termite or *vice versa*. No experiment has been devised so far to determine this point. According to Pinto its distribution is restricted to elevations below 2,000 feet and as a pest of tea, it is most commonly found in the Kelani Valley District.

Subterranean termites, sometimes known as "scavengers," are intimately connected with wood rot and dieback and it is asserted that the elimination of these two problems will eventually solve the subterranean termite as well. Applications of "Intox 8" are a palliative when these termites are a source of destruction in nurseries and new clearings. However, termites are one of the entomological problems awaiting investigation by the Low-country Research Station.

Tea Tortrix (*Homona coffearia* Nietn).—Outbreaks of this caterpillar pest of tea during the first half of the year were traced to the temporary absence of *Macrocentrus homonae* Nixon. This larval parasite, popularly known as the long-tailed parasite was imported by the Institute from Java in 1935/1936, when after only two liberations it has been most efficient in keeping Tortrix under control—almost a world record.

Redman King and Ranaweera together have recorded a list of 26 indigenous parasites which they bred from tortrix (1 egg parasite: 22 laval and

3 pupal parasites). Though Redman King thought these parasites were of very little economic importance it must be stated here, for purposes of record, that they appear to have been eliminated by *M. homonae*. Very rarely, if at all, are these local parasites met in the field or in collections sent to the laboratory.

A very severe outbreak of Tortrix followed an application of Aldrin dust for the control of subterranean termites in the field on an estate in Nawalapitiya district. The dust should have been applied to the soil, but was instead applied to bushes carrying foliage.

Green Bug (*Coccus virdis* Green):—This scale insect has always remained a pest in the Haputale area. The sooty mould which accompanies an outbreak, since it develops on the secretions of the bug, is always the first indication of the existence of the pest. The bugs themselves are confined to the undersides of the leaves and tender shoots and owing to their greenish colour escape early detection. The pest is however very effectively controlled by an entomogenous fungus *Cephalosporium lecanii*. Should spells of dry weather adversely affect the fungus, the scale then gets an ascendancy. If the affected tea happens to be recovering from pruning in a new clearing or nursery, insecticidal treatment is called for.

An experiment to test the efficacy of 3 insecticidal sprays was carried out on an estate in the Bandarawela district when the following were tried out:—Albolineum (Messrs. Imperial Chemical Industries Ltd.), Basudin (Messrs. Baurs Ltd.), Fernasul (Messrs. Imperial Chemical Industries Ltd.). Each treatment was replicated 5 times and the plots randomized. Three applications were made at approximately weekly intervals followed by an examination after each application. Mortality recorded at each of the 3 examinations was as follows:—

Insecticide	*Dilution*	*Mortality %*		
		1st Exam.	*2nd Exam.*	*3rd Exam.*
Albolineum	1 in 67 pts. (volume)	40	58	78
Basudin	1 in 2,000 ,, ,,	97	99	100
Fernasul	1 in 40 ,, ,,	55	58	70

Shot-hole Borer (*Xyleborus fornicatus* Eich).—The problem continues to receive the entire attention of the Special Entomologist who has been investigating it since 1955. Having completed his observations on the bionomics of the beetle and standardized a measure of assessment for general use, Dr. Judenko is now concentrating on chemical control. Mr. E. F. W. Fernando, the new Technical Assistant, has written a descriptive note of the immature stages of *Xyleborus fornicatus*.

Nettle Grub.—Of the 31 reported outbreaks during the year, 21 were in the Badulla district, 5 each in the Passara and Haputale districts, and only one from the Kandy area. With the exception of a single outbreak of the Blue-striped nettle grub, *Parasa lepida*, from the Bandarawela district, all the remaining outbreaks were limited to the Fringed Nettle Grub, *Natada nararia*, with occasional appearances of the saddle backed Nettle Grub, *Thosea cervina*, and the small green gelatine grub, *Narosa conspersa*.

Experiments with "wilt" disease.—Further field trials with the semi purified granulosis virus received from Dr. Kenneth M. Smith of Cambridge in 1956, gave very encouraging results. The experiment was carried out at the Passara Sub-Station where there was no evidence of Nettle Grub outbreaks within a radius of 10 miles. The bushes were artificially infected by collecting Natada cocoons from some other district and allowing the emerging moths to oviposit on selected bushes which were enclosed within large field cages. As

soon as eggs commenced to hatch the bushes received a 1 per cent spray of the virus.

The following table summarises the results of 2 examinations made a fortnight and 3 weeks after application.

	1st Exam.		*2nd Exam.*	
	Treated	*Control*	*Treated*	*Control*
Total leaves examined ...	50	50	50	50
Days after application ...	14	14	21	21
Total larvae found ...	320	260	213	216
Total larvae living (healthy)	125	260	15	216
Total larvae killed by granulosis ...	195	0	198	0
% Killed by granulosis ...	61.0	0	93.0	0

The mortality of 61.0 per cent and 93.0 per cent a fortnight and 3 weeks after application, respectively, is striking. The results indicate (1) the possibilities of starting an artificial epidemic of "Wilt" disease during the early stages of an outbreak, and (2) that the virus after extraction does not lose its infectivity for at least 12 months when left in cold storage.

Mites.—Reference was made in the report for 1956 (Bulletin No. 38 p.p. 52 and 53) to a field trial at St. Coombs against the Scarlet Mite *Brevipalpus australis.* The experiment was originally laid out in field No. 9 but unavoidable circumstances necessitated its transfer to No. 13.

The two treatments are as follows:—

(1) Application of Sulphur (as "Spersul") as a post-pruning spray in 4 applications at 2 week intervals, the first being given 3 weeks after pruning. Concentration and rate of application—1 lb. in 25 gallons water and 40 to 50 gallons per acre.

(2) Application of a non-tainting acaricide (Akar in the dilution of 1 in 1,000 by volume) as a light superficial spray incorporated in the normal routine Blister Blight Control spray (15 gallons per acre) commencing 3 weeks after pruning and continuing through the cycle.

Dry weight yields were recorded and estimations of mite populations made monthly.

Up to the end of July, 1957, when the tea in the experimental area was 13 months old, and the Akar treated plots had received 53 applications, it was noticed that the mite populations had not decreased to an extent to commensurate with the number of applications of the acaricide. It was then decided to drop the Akar treatment altogether. A second assessment was made in December, 1957.

Treatment	Summary up to 29-7-57 13 months from pruning			Summary up to 31-12-57 18 months from pruning		
	Total Mites	% Mites compared with untreated	Total dry weight lbs.	Total Mites	% Mites compared with untreated	Total dry weight lbs.
Akar	4,923	58	157	8,509	67	295
Sulphur	2,586	30	153	6,355	50	288
Untreated	8,448	100	158	12,610	100	297

Summaries of dry weight yields and mite assessments as made at the end of July and again in December 1957 are tabulated above.

As a result of treatments at both periods yields show no significant difference.

A second field experiment was laid down on Gouravilla Estate, Upcot, and is conducted with the active assistance and co-operation of the Superintendent, Mr. P. Easteal. This experiment originated after a discussion at a meeting of the Mite Consultation Committee. The two treatments are (1) Heavy applications of sulphur at pruning followed by annual applications (3 rounds) of the same acaricide till the end of the pruning cycle (2) Heavy applications of sulphur immediately after pruning followed by annual applications of Akar (3 rounds) Plucking carried on as usual.

The experiment is in progress. It is chiefly directed against Scarlet Mite.

Screening Tests.—Seven acaricides were tested under field conditions. The table which follows enumerates the acaricides tested, concentrations used, mites against which the sprays were directed, and brief remarks as to whether the sprays were satisfactory or not. The tests are being repeated.

Acaricide	Concentration	Mite	Remarks
Basudin	1 part in 2,000 parts	Scarlet mite (*Brevipalpus australis*) Purple mite (*Calacarus carinatus*)	Unsatisfactory Satisfactory needs repeating
Malathion	1 part in 400 parts 1 part in 500 parts 1 part in 1,000 parts 1 part in 400 parts	Scarlet mite (*Brevipalpus australis*) Scarlet mite (*Brevipalpus australis*) Scarlet mite (*Brevipalpus australis*) Yellow mite (*Hemitarsonemus latus*)	Unsatisfactory —do— —do— —do—
Akar	1 part in 1,000 parts	Yellow mite (*Hemitarsonemus latus*)	Unsatisfactory
Aramite	1 lb. in 50 gallons	Scarlet mite (*Brevipalpus australis*)	Very satisfactory
Tedion W.P.	1 lb. in 50 gallons 1 lb. in 100 gallons 1 lb. in 100 gallons 1 lb. in 100 gallons	Scarlet mite (*Brevipalpus australis*) Scarlet mite (*Brevipalpus australis*) Purple mite (*Calacarus carinatus*) Yellow mite (*Hemitarsonemus latus*)	Fairly satisfactory Unsatisfactory Fairly satisfactory Fairly satisfactory-needs repeating
Tedion emulsion	1 part in 1,000 parts	Yellow mite (*Hemitarsonemus latus*)	Fairly satisfactory-needs repeating

The Mite Consultative Committee met twice during the year. Mr. Peter Wright of Brunswick, Maskeliya, resigned his seat on leaving the Island. He was succeeded by Mr. H. Stacey Hawkes of Kottiyagalle, Bogawantalawa. Mr. P. Easteal of Gouravilla, Upcot, was invited to join the Committee during the course of the year.

G. D. AUSTIN
Entomologist.

REPORT OF THE ENTOMOLOGIST, SPECIAL RESEARCH, FOR THE YEAR 1957

General.—As during the previous year work of the Entomologist, Special Research, was confined solely to the shot-hole borer (*Xyleborus fornicatus* Eich).

Biology.—Investigations on the appearance of the beetles on bushes out of galleries under field conditions, showed they were appearing almost all over the 24 months pruning cycle, and that this circumstance would allow us to carry out experiments on chemical methods of prevention of shot-hole borer attack on tea at any time.

The following observations were made in the laboratory experiments, on two bushes of height 2½ ft. and 4 ft., previously infested by shot-hole borer. Some of the beetles which emerged from the galleries dropped onto or walked to the soil surface under windless conditions and some of these beetles also burrowed into the soil. The appearance of the beetles in the soil, confirmed by other experiments, would indicate the necessity to investigate this problem under natural conditions, examining different types of soil of the fields infested by shot-hole borer. If a large number of beetles could be found in the soil, trials of different chemicals on these beetles might be important.

It was found out in the same laboratory experiment that the great majority of the beetles were walking at least for some of the time on those parts of the bushes which were not higher than one foot above the ground level. This would indicate that the lower parts of the tea bushes are not only the places where some of the females make galleries but also the places through which many beetles pass, and would allow us to carry out experiments on spraying the lower parts only. This type of spraying would largely eliminate any danger of chemical poisoning of the harvested crop and, at least partially, destroying beneficial insects.

Preliminary experiments on chemical methods of prevention of shot-hole borer attack on tea in plucking.—(*Laboratory experiments*).—Of the four insecticides tested, Dieldrex—Extra and Clordox gave the best results.

Field experiments.—Preliminary experiments with Dieldrex—Extra and Clordox sprayed on the lower parts of the bushes only, gave promising results with regard to the percentage of kill of the beetles concerned within 2½-3 months after treatment. No injuries were caused to the tea bushes by these sprayings.

Further trials are being carried out and no practical recommendations emerge from the above mentioned experiments.

Influence of the method of bringing tea plants into bearing on shot-hole borer infestation.—Experiments were carried out on 3 estates during April/May 1957, in 1955 clearings, on the effect of centring and half-cutting. Examination of the plants in November 1957 after the plants were cut a second time showed no difference in shot-hole borer infestation between the two methods.

Assessment of the infestation of Tea Seed bearers by shot-hole borer.—

Table 1.

Number in order	Estate	Number of galleries per 50 standard units		Approximate elevation in feet
		Tea seed bearers	Adjoining tea fields in plucking	
1	Niriella	1	Isolated area	500
2	Welimaluwa	8	22	400
3	Denawake	9	42	800
4	Kuttapitiya	13	Isolated area	1,100
5	Wellandura	15	19	900
6	Lansdowne	16	Isolated area	700
7	Galbode	20	56	1,200
8	Pelmadulla	29	38	800
9	Lellopitiya	30	41	900
10	Mahawale	37	71	800
11	Madampe	42	50	1,000
12	Hapugastenne	47	88	2,500
13	Alupolla	52	47	2,900
14	Depedene	83	102	1,900

Conclusions.—(i) The problem needs further detailed studies; it is possible that high infestation of seed bearers by shot-hole borer causes loss of weight of seeds and reduction in the percentage of germination of seeds.

(ii) Results indicate that seed bearers grown in isolated areas are possibly infested to a lesser degree.

Assessment of infestation of some tea clones by shot-hole borer.—

Table 2.

Number in order	Number of galleries per 50 standard units	Estate	Clone	Approximate elevation in feet
	A. Clones whose yield is considered good by Superintendents.			
1	0	Palmgarden	T.R.I. 2023	120
2	2	Wellandura	Wellandura 34	1,000
3	7	Palmgarden	T.R.I. 2026	120
4	11	Craighead	C.H. 13	3,000
5	14	Somerset	S.S. 1	2,200
6	27	Palmgarden	T.R.I. 25	120
7	28	Delta	S/4/51	3,200
8	28	Gonakelle	T.R.I. 2024	3,700
9	42	Delta	S/4/40	3,200
10	43	Palmgarden	G.K. 518	120
11	46	Balangoda	D.G. 7	3,500
12	52	Gonakelle	T.S. 35	3,700
13	60	Delta	S/4/25	3,200
14	65	Kenilworth	16/3	2,000
15	107	Niriella	3-B 22	600
16	111	Niriella	1-B 7	600
	B Clones whose yield is considered unsatisfactory by Superintendents.			
17	5	Palmgarden	T.R.I. 37	120
18	8	Delta	S/4/63	3,200
19	59	Gonakelle	P.D. 13	3,700
20	93	Gonakelle	T.R.I. 1294	3,700

Conclusions.—(i) Results from Nos. 15, 16, 17 and 18 would indicate that shot-hole borer infestation is not a sole factor which influences the yield of tea.

(ii) Results from Nos. 1-5 show that some of the clones have both good yield and none or very little shot-hole borer infestation; it may be found necessary to grow and examine these clones in estates highly infested by shot-hole borer.

E. JUDENKO,
Entomologist, Special Research.

REPORT OF THE LOW-COUNTRY SCIENTIFIC ADVISER FOR THE YEAR 1957

General.—There were no administrative or staff changes during the year. The closest liaison was maintained with the specialized research divisions of the Institute which in one way or another had activities in the low-country, and notably with the Vegetative Propagation Division which is responsible for the administration of the V.P. station at Neuchatel.

My report on the organisation of a low-country sub-station was accepted by the Board in June. The two main recommendations made were:
(1) the purchase of an estate of a minimum of 300 acres tea, with adjacent jungle or old rubber land for future development under the crop, in the Ratnapura—Kelani Valley area which is considered to be the best location for the establishment of a research station for the low-country, and
(2) the setting up, in due course, of three vegetative propagation units of about 25 acres each in the Galle, Morawak Korale and Kegalle districts respectively, in addition to the station at Neuchatel in the Kalutara district. Action to implement these recommendations has already been initiated and an application to Government for a loan of Rs. 2½ million for the purchase of a suitable estate and the erection of laboratories, staff quarters, etc., has been made. Application will also be made to the Colombo Plan and other Technical Aid Agencies for assistance in regard to specialized laboratory and factory equipment and pilot plant.

Every opportunity was taken to establish contact with members of the planting community engaged in tea cultivation in the low-country. 152 visits to estates were made during the year, 70 of these being for investigational and 82 for experimental, advisory or administrative purposes. The former are comprised as follows:—Galle and Matara districts 24, Ratnapura and Rakwana 19, Morawak Korale 10, Kalutara 7, Kegalle and Kandy 7, and Kelani Valley 3.

The number of letters, etc. issued during the year was 1,162. Of these about two-thirds were in connection with advisory or investigational visits to estates.

Fourteen meetings of District Planters Associations were attended during the year and 12 addresses given in connection therewith. Three meetings of the Low-country Sub-station Committee of the Board, of which the Adviser is Convener, were held since August. Meetings of the Experimental and Estate Committee and, on occasion, of the Board and of the Co-ordinating Committee were also attended by request.

An aerial survey by helicopter was made, at the instance of Government, along with Mr. A. Watt of Endane, of areas in the low-country available for development under tea. Field survey observations were made and soil

sampling undertaken of areas proposed for development under tea by Government at Pelawatte, Kalutara District, and by peasant colonists at Derangala and Dangalla, Morawak Korale.

To all members of the planting community in the low-country who have readily co-operated with me in diverse ways in fulfilling the terms of my assignment, I express my sincere thanks. I am also very appreciative of the generous hospitality extended by them to me on many occasions and thank them very cordially. I have pleasure in expressing to the management of estates on which our experimental work is conducted our deep appreciation of the facilities they have so readily provided us.

Field Experiments.—1. *Pruning cum Shot-hole Borer Experiment.*—This trial completed its fifth year in June. Estimations of shot-hole borer incidence in plots by Dr. E. Judenko confirmed that the degree of attack by the pest was very low. The yields to the end of December, 1957, eliminating the period July to December, 1956, the records in respect of which were omitted for good reason, are furnished below:

Cycle	*Total yield lbs. per acre*	*Average annual yield lbs. per acre*
18 month	5,625	1,125
2 year	5,238	1,047
2½ year	4,973	995
3 year	5,546	1,109

These results indicate that under the conditions specified, the plots of the 18-month and 3-year cycles outyielded those of the 2½ year cycle by about 120 lbs. per acre per annum, on the average, and the 2-year cycle plots by about 70 lbs. per acre per annum. The latter figure is reduced very appreciably when the data for the period July 1955 to June 1956 is eliminated. Insecticidal spray treatment of the plots against shot-hole borer in 1956, as would be expected with the very low incidence of the pest, had no effect on yields. A detailed study of the yield and rainfall figures since the start of the trial showed that, in general, there was a fairly close direct relationship between the two when recordings were made at 3-monthly intervals.

2. *Chlorosis Trials.*—Two trials were started with the assistance of the Chemist in May 1957 on a sandy area of Talgaswella Estate, Elpitiya, where chlorosis was very marked, to ascertain the effects of high levels of potash and magnesium, singly and in combination with the minor elements zinc, copper, manganese and boron, and with and without cattle manure, on the affected bushes. A 2^5 factorial design was adopted in each case, and as the condition varied from bush to bush, a single bush plot was decided on. The treatments were in duplicate. In a number of the bushes the chlorosis was found to be associated with algal red rust (*Cephaleuros parasiticus*). An examination of the bushes to date revealed that magnesium (applied as dolomite) and potash had marked effects in improving bush condition and leaf colour, while cattle manure, zinc, and copper appear also to have been beneficial, the last-mentioned particularly by its effect on leaf colour.

Low-country chlorosis, particularly of the rim lungs and associated with red rust, has been investigated in collaboration with the Research Assistant in Plant Pathology whose findings on this subject will be found in the Acting Plant Pathologist's report. It would suffice here to state that this condition is fairly widespread in the low country, but little damage is done except in areas

of old tea subjected to severe neglect or where the general nutritional level of the soil is very low. The condition appears to be intensified during and subsequent to a drought.

3. *Other Trials.*—Other experimental work in the low-country will be dealt with in the reports of the Special Entomologist for shot-hole borer, Dr. E. Judenko, the Plant Physiologist and Vegetative Propagation Officer in respect of manurial trials on tea, vegetative propagation, pruning systems and cycles, methods of bringing young tea into bearing, etc., the Chemist, on potash, calcium and magnesium nutrition, and the Plant Pathologist on wood-rot and its control.

Miscellaneous.—*Pruning Methods.*—There is a marked increase of interest in the new method of pre-pruning (reverse rim-lung prune) first adopted by the Superintendent of Maliboda Estate, Deraniyagala, and the results observed so far as recovery from pruning, elimination of dieback and improved bush condition are concerned, have been very satisfactory. The limited yield data available indicate that the method appears to be advantageous from this standpoint as well. One estate which has now adopted this system of pruning as its normal practice has carried out the pre-pruning of the entire periphery of the bushes, where these are not on the contour, with reported beneficial results. The orthodox method has been tried out on one or two estates during dry weather with no observed ill effects.

Manuring, Green manures and Shade trees.—The adverse effect of the deep forking in of manures in areas where the rainfall tends to be marginal has been noted to be very marked, and also that of leaving green manure tree crops like *Gliricidia* unlopped during prolonged periods of drought in such areas. Bush green manures in new clearings may also prove distinctly disadvantageous to tea seedling survival if these crops are allowed to grow unchecked during the dry season. Striking confirmation of this observation has recently been obtained from Nyasaland. In all these cases, the cause of the trouble is mainly the competition of the green manure tree or bush plant for moisture during the drought. Bush green manure crops should, therefore, be lopped to a reasonable height at the start of the dry weather and the loppings used as a mulch around the plants along with other thatching material, *e.g.* Guatemala grass. In the case of tree green manures, alternate rows or preferably every other tree, should be lopped before the drought sets in.

Replanting.—It has fairly frequently been observed that tea planted in old rubber land does quite well without any particular rehabilitation treatment in the case of seedlings. Apparently the rotation of rubber with tea is not inimical to the latter. Whether this observation will hold with vegetatively-propagated material as well, experience alone will indicate. Tea following tea has also been noted to be coming up well in a few instances where this is being tried out, but it would obviously be very unwise to adopt extensive replanting of such land without some period of soil rehabilitation with a crop such as Guatemala grass treated as directed by the Chemist.

Land under fern (*kekilla S*) has been reported to be quite suitable for tea, but apparently the crop takes about a year longer than normal to come into bearing. The application of dolomite limestone to such land has been found to be very effective in killing off the fern in the Deniyaya district.

New Clearings.—Many estates now adopt some form of bending or layering or thumbnailing, as opposed to the earlier method of centering, in bringing young tea into bearing and the results are reported to be very satisfactory.

Vegetative propagation.—Many estates in the low-country have now started on a programme of vegetative propagation and some have made considerable strides with the selection of mother bushes, nursery techniques, and the multiplication of clones. The T.R.I. clones which appear to be most popular and are doing best in the zone are 2026, 2023, 2024 and, to a lesser degree, 2025. A number of estates find transplanting clonal plants direct from the nursery to the field very successful provided that this is done in the rainy season. Manuring young clonal plants with Sterameal or other suitable organic manure is almost universally practised with good effect on vigour and growth. In a few instances where yellowing characteristic of magnesium deficiency was observed on the leaves of some multiplication bushes, the application of a small quantity of magnesium sulphate has had very striking effects on colour restoration and bush condition. It was very satisfactory to note that 10 ft. contour strips of Guatemala grass were retained between every 100 rows of tea in a V.P. clearing in the Morawak Korale.

The yield to date of a 10 year old mixed clonal clearing of 2½ acres extent on a well-known estate in the Kelani Valley was reported to be 2,645 lbs. per acre as against a yield of 1,552 lbs. per acre on an adjacent block of seedling tea of the same age on the same slope.

Maintenance Leaf-fall.—The Research Assistant in Plant Pathology has given his attention to this subject and has isolated, among other fungi, *Rhizoctonia spp.* from the diseased leaves of affected bushes on an estate in the low-country. Two sprayings of the bushes with copper fungicide at the usual concentrations are reported to have given satisfactory control of the trouble. The occurrence of maintenance leaf-fall and/or of shot-hole borer necessitates the adoption of short pruning cycles in parts of the low-country.

Pests and Diseases.—Apart from shot-hole borer which is the major pest of tea in the low-country with the exception of the Galle and Kalutara districts, termites and mites are the commoner pests of the crop in the zone. Termites were reported to be particularly troublesome in the Galle-Matara district following on the March-April drought last year, but investigation by the Entomologist revealed that the trouble, in one area at any rate, was caused by the subterranean species *Termes horni*, a scavenging type which only attacks dead tissue, and that the termites should, therefore, be considered of secondary importance. Fairly severe mite incidence was reported from the Rakwana-Deniyaya area during the September-October drought, and successful extension talks on the recognition and control of these pests were given by officers of the Entomological Division. Blister blight was not reported to be particularly troublesome during the year, but wood-rot continues to be the major disease problem in the low-country. Investigations on the prevention of this disease are in progress.

A. W. R. JOACHIM
Adviser, Low-country Tea Research.

The Tea Research Institute of Ceylon

The Smallholdings Advisory Service

Staff at December 31st 1957

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NOTE

The Laboratories of the Institute are situated at St. Coombs Estate, Talawakelle, and letters and enquiries should be addressed to the Director, Tea Research Institute of Ceylon, St. Coombs, Talawakelle, Telegraphic Address:—Research, Talawakelle, Telephone:—Talawakelle 44 (private exchange). Replies to correspondence addressed other than "The Director" may be subject to some delay. Specimens and other consignments sent by rail should be forwarded to Talawakelle station, C/o Messrs. M. Y. Hemachandra & Co., Ltd., Forwarding Agents. Carriage should be prepaid. Letters concerning these specimens, etc., should be sent under separate cover.

The Tea Research Institute of Ceylon

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